FOUNDED BY DR. MAX THOREK

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Once in a Lifetime: Hail and Farewell to a Titan

AT long, long intervals in this suffering world there appears a human being who defies comparison, not only with all other human beings but with anything known to man save a cosmic force—a man whose creative genius does not burn but strikes, like lightning; whose lust for life is no less than his titanic capacity for living; before whose energy stone walls melt like snow; who calls no man stranger, having known all men from birth; who describes a meteor's arc by his mere passing, so that men start awake and look up and marvel. At still longer intervals, as though all this were not sufficiently startling, such a man appears with a heart so full of human understanding and hands so full of help that he needs must sow them abroad like seed in springtime, lest by the excess of their weight they hamper him in his ceaseless quest for—what? Not wealth, fame, comfort or happiness; all these may be easily within his grasp, but they cannot stay him.

It goes without saying that such a man cannot rest. With all his powers, the power to rest is not in him. What, rest? when there is sickness here, famine there, war and hatred and ignorance and malice devouring their thousands? Perish the thought. Life is short enough at its longest, with all there is to do.

To have known one such spirit in one lifetime is to have been given much, for such a man is more than a man; he is an experience. And such a man, as those are aware who were so fortunate as to be counted among his friends, was Dr. Max Thorek.

How strange it is to write "was" of Dr. Max. It is like turning down a part of the light of the world; like approaching a many-windowed house within whose walls one has again and again known warmth and light and hospitality and comradeship, and having its walls dissolve before one's eyes. The whole surrounding landscape is dimmed and dulled, strange to the eye and impalpable to the touch; and, despite the fact that we know Dr. Max will live

on in thousands of the lives he enriched by living at all, it is hard to think that we shall not see him again.

All hearts are heavy that loved him, and their name is Legion. Many of us he has drawn with strong, skilled hands through the Valley of Death, and brought forth triumphant on the other side. Many another will feel again and again, with a longing wrench of the heart, the warmth of his handclasp, and hear his loved voice speak the words he spoke most often: "God bless you and keep you, my friend."

For the word "friend" meant exactly that to Dr. Max. He was a friend whose friendship, once won, was given freely, fully, ungrudgingly and with overwhelming appreciation and gratitude. He could not say enough or do enough for those who truly shared his labors of love. His confidence, like that of anyone whose trust is worth having, had to be earned, but once earned it was as secure as the Rock of Gibraltar. He was a great, even an inspired surgeon, yet for those to whom he revealed his attitude toward surgery the word "humility" took on new meaning. He was so versatile in his interests, so many-faceted in his personality, so vividly original in conversation and of such inexhaustible vitality and vivacity of mind that to all who loved him—his family, his friends, his colleagues, the far-flung brotherhood of the College he founded, and the staff members who worked with him in College and hospital—every thought of him will be forever compounded of laughter and tears, tenderness and surprise, humility and aspiration, courage and compassion, now weighted in this direction, now in that, but always with an undertone of nostalgia and regret, for we know too well that "we shall not look upon his like again."

Dr. Max had high standards, and he would not lower them or see them lowered; it was a perpetual challenge to be his friend, his co-worker, or his ally in any enterprise. He demanded much, but he gave much in return. He exacted the last full measure of loyal endeavor, but he never asked more of anyone than of himself.

Few men can say as much, and none can say more. God bless you and keep you always, dear Dr. Max.

But there are deeds which should not pass away,
And names that must not wither, though the earth
Forgets her empires with a just decay,
The enslavers and the enslaved, their death and birth.
The high, the mountain-majesty of worth
Should be, and will, survivor of its woe,
And from its immortality look forth
In the Sun's face, like yonder Alpine snow,
Imperishably pure beyond all things below.

—*Byron*

General Surgery

Situs Inversus

Review of the Literature, Report of Four Cases and Analysis of the Clinical Implications

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ALTHOUGH rare (1:5,000 to 1:10,000), situs inversus is nevertheless an important clinical condition—a condition the physician and surgeon must be alert to recognize, since a number of important malformations and diseases have a higher than normal rate of occurrence in the person with situs inversus. More important is the fact that many of these conditions must be surgically corrected; some very early in life, as for example, pyloric stenosis or cardiac and great vessel malformations, while others, such as bronchiectasis or malformations of the lower vertebrae, may not require attention until later in life.

The predilection of persons with situs inversus to certain diseases was noted by Kartagener in 1933. He recognized the fact that the syndrome of hypertrophic rhinitis, nasal polyposis, sinusitis and bronchiectasis occurred more frequently in such persons than in the normal population. Since this recognition Torgersen (1927) has shown bronchiectasis and nasal polyps to occur in as high as 10 per cent of persons with situs inversus. Later (1949) he observed bronchiectasis alone in 25 per cent of these persons. Cardiovascular malformations occur in approximately 8 per cent (Schmutzer and Linde, 1958)

Situs inversus as observed at autopsy in 4 cases is described, with the associated defects, anomalies and pathologic changes. The literature is reviewed, and various theories concerning the etiologic factors are discussed. The authors point out the omission, in many published reports, of pertinent data concerning age, sex and the multiple congenital defects that frequently accompany the condition, stressing the need for adequate surveys and accurate classification. In particular, roentgen studies of the chest should include a search for possible dextrocardia. Early recognition of situs inversus, partial or complete, is highly desirable and would greatly assist in the solution of the many problems involved.

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and the incidence of agenesis of the spleen, diaphragmatic defects, spinal anomalies and other defects, although apparently higher than in the normal population, cannot be estimated with any degree of accuracy.

The transposition of viscera may be complete, with the heart, lungs and all abdominal viscera reversed, or incomplete, manifesting itself as a simple reversal of the stomach or liver (ectopia). Between these extremes will be situs inversus without dextrocardia, so-called devocardia, dextrocardia without situs inversus, transposition of the great vessels, the lungs or the liver, transposition of the stomach and the first part of the duodenum or transposition of the colon. Heterotaxia, situs transversus, reversed asymmetry and lateral transposition are synonymous terms that may be encountered in the literature.

The incidence of situs inversus in the general population is difficult to determine or predict. A number of comprehensive studies, however, have revealed some interesting facts about patterns of inheritance and associated pathologic conditions in those so affected.

Mayo and Rice (1949) reported 76 cases of situs inversus viscerum totalis in 1,551,047 patients who registered at the Mayo clinic from 1910 to 1947, an incidence of 1:20,000. They emphasized the fact that other anomalies that are incompatible with life may be associated with situs inversus and that the incidence is undoubtedly much higher. It should be pointed out, too, that in a hospital population the element of selection must also be considered. Torgersen (1946 and 1949), in a roentgenographic survey of 1:500,000 Norwegians, noted 195 cases of situs inversus, approximately 1:8,000. In another mass radiographic survey, Gould (1945) recorded 40 cases of situs inversus in 442,252 subjects, an incidence of 1:11,000. Adams and Churchill (1937) reported 23 cases in which the condition was diagnosed at Massachusetts General Hospital in 232,112 admissions, and Caplan (1946) reported 12 cases in some 100,000 examinations for enlistment in the Navy, an incidence of 1:8,400. Other authors have reported higher and lower incidences of situs inversus, but many have failed to specify whether the situs inversus was complete or partial. A survey of the literature by Johnson (1949) is interesting in this respect, because it indicates the relative frequency of the varieties of situs inversus. Reviewing the literature from 1925 to 1946, Johnson found 515 cases of dextrocardia, with no indication in the report whether situs inversus was or was not present. There were 379 cases of situs inversus viscerum totalis, 128 cases of isolated dextrocardia, 41 cases of partial situs inversus, 46 cases in which only the colon was involved, 20 cases in which only the great vessels of the heart were affected, 6 cases in which the stomach alone was involved and 2 cases of transposition of the liver. Considering all these data, an incidence of 1:8,000 seems to be a realistic figure for situs inversus viscerum totalis as observed in hospital admissions. It should be borne in mind that the incidence of all types of transposition is undoubtedly higher, and that many cases will be missed when (1) defects incompatible with life exist or (2) the subject is completely healthy and never requires the type of medical examination that would reveal the condition.

It is readily apparent that visceral reversal is part of a much larger basic problem, namely, the manner in which bilateral symmetry and asymmetry are established normally in any animal. In addition, the problem of twinning is intimately associated with the occurrence of situs inversus. There have been numerous studies of both vertebrate and invertebrate forms in which induced or spontaneous twinning has resulted in situs inversus in one of the twins (Hamburger,

1942; Gates, 1946). A study of these important problems and the analysis of conditions associated with situs inversus has given rise to a number of hypotheses concerning genetic constitution and the mechanisms by which inversion can be accomplished. Cockayne (1938) stated that complete transposition of the viscera agrees with what is expected of a rare recessive character in its familial incidence and gene distribution within a family; in its occurrence in both members of a pair of monozygotic twins whose parents are normal; in the high percentage of first cousin marriages that give rise to it, and, so far as can be determined, in the ratio of affected to normal children in sibships. His analysis revealed that other developmental abnormalities, such as congenital heart disease, are more common in persons with transposition than among the general population and that this liability to defective development is much greater with partial than with total transposition. Cockayne concluded that complete transposition is inherited as a recessive character determined by a single autosomal gene, and in his opinion partial transposition is probably determined by the same gene, the higher incidence of associated anomalies requiring the classification of this gene with the partially lethal group. Cockayne's theory has received support from several studies of laboratory animals as well as from clinical studies. It is noteworthy that in mice, when genetic constitution can be critically tested, studies have shown that this condition can be inherited as an autosomal recessive character with incomplete penetration. Tihen, Charles and Sipple (1948) reported such an inheritance in a strain of mice in which the viscera and blood vessels were reversed. In addition, these mice had abnormalities of the spleen and lungs and malposition of the postcaval and hepatic portal veins. The mortality rate among these mice was high, with many cases of what appeared to be hydrocephalus. Hummel and Chapman (1959), at the Jackson Memorial laboratories, have produced a strain of mice with situs inversus which reveal the same type of inheritance. These animals have abnormalities of the blood vessels, spleen, liver and lungs but are healthy and fairly good breeders. Five hundred and seven mice born to parents with transposed viscera were examined by these workers. They observed that 29.6 per cent had complete reversal without abnormalities and 41.8 per cent had partial reversal, coupled in most cases (81 per cent) with anomalies of the blood vessels—a total of 71 per cent with situs inversus. The lung lobation was abnormal in 20 per cent and the shape or position of the spleen in 29 per cent. The association of these anomalies with partial situs inversus rather than complete reversal is extremely interesting, since it agrees with Cockayne's observation of the human species.

Torgersen (1949), on the other hand, came to different conclusions with regard to the genetic aspect of reversed asymmetry. On the basis of a thorough analysis of the varied theories as to the causes of situs inversus, its relation to disease and its familial incidence, he presented the following interesting points:

1. The frequency of situs inversus in Norway, a small and geographically limited population, is somewhat above 0.01 per cent (1:10,000).

2. The frequency of situs inversus is not much higher in monozygotic twins than in the general population. There is some evidence, however, of a correlation between twinning and situs inversus in a few cases, particularly when there are many twins in the paternal lineage.

3. The ratio of affected to normal persons does not accord with the supposition that a single recessive gene is generally the cause of situs inversus. Instead, Torgersen postulates from the morphologic

and genetic points of view that the asymmetry of the viscera, whether normal or reversed, is due to a complex of genes that may be broken up into components of particular importance for particular organs. The reversal syndrome behaves as a dominant, with varying expression and chance of inversion in heterozygotes and homozygotes, the complete reversal of asymmetry depending on the integrative action of the complex of genes. In a later paper (1950), Torgersen refuted the theory that twinning and reversal of asymmetry are closely related phenomena; among the parents and siblings of 100 unselected patients with situs inversus, twinning (and also left-handedness) was not observed with any greater frequency than might be expected on the basis of chance alone. He also stated that the developmental potentialities for bilateral differentiation of the human egg are so strongly determined genetically that the mirror-image mechanism, as revealed in experimentally produced amphibian twins, has relatively little importance in human polyembryology. The latter is a reference to the work of Stockard (1921), Spemann and Ruud (1922), Komai (1938) and Lutz and his associates (1957), among others, who have investigated the effects of temperature, chemicals and general delay of gastrulation of the twinning and monster formation in certain fishes and amphibia.

In general these workers have shown that in some, but not all, cases of complete and incomplete twinning the asymmetry of one twin will be reversed (a mirror image). Torgersen may have underestimated the occurrence of the phenomenon in human development. Its importance as a mechanism of situs inversus is also strongly suggested by the reports of Newman (1940), Aird (1954) and others that situs inversus frequently appears in laterally conjoined human twins, the right-hand member being the one affected, an apparent mirror-image effect. Also, the fact that twinning can be initiated at different stages of development and with different end results has been shown by the study of Keeler (1929). He compared the amount of mirror-imaging in 10 sets of human double monsters and 14 sets of identical twins. Only 22 per cent showed mirror-imaging in monozygotic twins, as compared with 77 per cent in laterally conjoined twins. Some further evidence of the complexity of factors in the occurrence of situs inversus is the fact that it has been observed 12 times in monozygotic twins, but in 6 of these sets it occurred in both members and in 6 cases in only 1 of the members (Torgersen, 1949). Lowe and McKeown (1954) described a pair of male twins, one with situs inversus and the other normal. Adding to the perplexity from a genetic standpoint are the facts that both were right-handed and had clockwise crown whorls, and that in both the right scrotal half was higher. Situs inversus has also been observed in both members of sets of dizygotic twins (Torgersen, 1948a).

From this welter of conflicting and fragmentary evidence several suppositions seem justified with regard to situs inversus in man:

1. A single autosomal recessive gene with incomplete penetration is responsible for situs inversus in many cases.

2. This gene is partially lethal, producing visceral, vascular and other defects.

3. Twinning, which in itself is a complex problem, is also responsible in some cases of situs inversus. For example, situs inversus may result from developmental arrest, when fission takes place after bilateral symmetry has been established, with the production of monozygotic twins, one of which is the mirror image of the other. Either of these twins may die at an early stage and be resorbed.

The large number of cases of situs inversus reported in the literature is proof of a widespread and continuing interest

in this anomaly. The condition has been observed in practically all races and nationalities of man and in association with numerous diseases and defects. The first report of situs inversus is credited to Aristotle, who described the condition in 2 animals. Since a historical review will not be attempted here, the reader is referred to the recent paper of Schmutzer and Linde (1958) for a brief historical account.

With the advent of roentgenography, there has been a steady increase in case reports. Cleveland, reviewing the literature in 1926, collected 400 cases and Johnson (1949) 632 cases of situs inversus in the literature from 1925 to 1946. The details of Johnson's review have been given earlier. In reviewing the literature since 1946, we have noted reports of 722 cases of situs inversus, including 124 cases of isolated dextrocardia. There have been 365 cases of situs inversus viscerum totalis, 159 cases of Kartagener's syndrome, 30 cases of levocardia, 24 cases of situs inversus with critical congenital defects, 17 cases of partial situs inversus, 2 cases of transposition of the stomach and 1 case of transposition of the liver. In addition, a new syndrome has been described by Polhemus and Schafer (1925); this consists of persistent atrioventricularis communis, partial situs inversus of the abdominal viscera, accessory lobes of the lung and congenital absence of the spleen. These authors described 4 cases observed in a two year period and reported 14 additional cases from the literature. Two additional cases have been reported recently (Goncerzewicz, 1957; Tersley, 1958), making a total of 20 cases of this syndrome in the literature. It seems safe to say that additional but rarer syndromes will be recognized in the future.

We have attempted, thus far, to present the classification, general and clinical occurrence and causation of situs inversus and to sketch briefly its relation to various defects and diseases. These points will be considered more fully and with clinical emphasis under *Comment*.

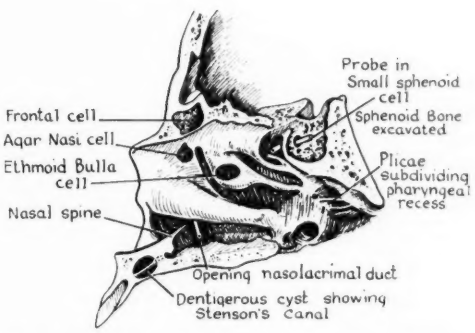

Fig. 1.—Lateral nasal wall in dissection in case of situs inversus, showing small sphenoid sinus, large ethmoid bulla cell, large agger nasi cell and dentigerous cyst with remains of Stenson's canal.

OBSERVATIONS

Observation 1. Dissection of Cadaver Specimen.—The subject was a 45-year-old Negro who died of paresis. No other history was available.

The Head: Grossly considered, the skull was normal. The paranasal sinuses, however, revealed several interesting features. The most obvious was the small size of the sphenoid sinuses, which together measured only 5 mm. in diameter. The cell of the ethmoidal bulla was greatly enlarged bilaterally, occupying a large part of the ethmoidal field. Fusion of the bullar wall with the middle concha on both sides resulted in absence of the suprabullar furrows. The left frontal sinus was doubled, consisting of an anterior cell that pneumatized the frontal bone and a posterior cell largely supraorbital. On the left side a large agger nasi cell opened, as usual, into the infundibulum. The infundibulum did not communicate with the frontal recess but ended blindly. A total of five anterior and two posterior ethmoidal air cells were present on the left side.

The right frontal sinus was 6 mm. from the midline, owing to the encroachment of the enlarged left frontal sinus. The right agger nasi cell was considerably smaller than the left, and very large posterior ethmoidal cells

were present. The maxillary sinuses were small; correspondingly, the canine fossae were shallow.

In the maxilla, 2 mm. above the roots of the medial incisors, was a dentigerous cyst measuring 10 by 8 mm. (Fig. 1). An opening in the floor of the nasal cavity led to a patent duct that passed through the center of the cyst. This duct seemed to be a remnant of the incisor canal, which rarely persists in the adult as an incisive duct, thus forming a communication between the nasal and oral cavities; the cyst arose from the proliferative activity of the duct epithelium. Each lateral nasal wall had four meatuses: the inferior, middle, superior and supreme, the middle being the widest. The nasolacrimal ducts were rather large and regular in their course and opened normally into the inferior meatus. In the nasopharynx, both pharyngeal recesses were subdivided into several smaller compartments by plicated strands of mucous membrane.

In their course and distribution the cranial blood vessels were within the range of normal variation. The cranial nerves were also normal. Noteworthy is the fact that the lingual nerve maintained a normal relation to the submaxillary duct. It lay first above, then lateral and finally below. Other aspects of the head were essentially normal.

The Neck: The thyroid gland consisted of two lobes joined by a small intermediate isthmus. The superior thyroid arteries arose as the first branches of the external carotid arteries. The inferior thyroid arteries arose from the thyrocervical trunks and formed an inverted U-shaped loop in their course to the inferior dorsal surface of the gland. Their relation to the inferior laryngeal nerves was normal, the terminal nerve fibers being dorsal to the arteries.

The Thorax: The heart and great vessels were characteristically transposed (Fig. 2). There was a sacculated aneurysm of the descending portion of the aortic arch that measured 6 by 3 cm. The walls of the aneurysm were lined with hard calcified arteriosclerotic plaques. The ligament of Botalli could not be identified, and no opening that would suggest a patent ductus arteriosus was observed. Except for their transposed position, the large veins of the heart were normal.

The heart was normal in size, measuring 12 cm. from base to apex and 9 cm. at its greatest width. Its transposition had produced no abnormalities, although a nonfunctioning probe patency of the fossa ovalis existed and the valve of the inferior vena cava and the coronary valve exhibited some degree of fibrous thickening.

The lungs were normal but transposed. The thoracic arterial blood supply was normal. The azygos system consisted of an azygos vein draining into the superior vena cava after arching over the left bronchus. The vessel collected blood from the eleven intercostal spaces of the left side of the thorax and the lower six interspaces of the right side. The five upper intercostal spaces of the right side drained directly into a vein, which in turn entered the right innominate vein.

The cisterna chyli of the thoracic duct was situated to the left of the abdominal aorta at the level of the second lumbar vertebra. After crossing through the aortic hiatus of the diaphragm, the thoracic duct immediately crossed to the right side and ascended first along the right side of the aorta and then in relation to the right side of the azygos vein. At the cervical level the thoracic duct left the right border of the esophagus, turned laterally and passed under the subclavian artery, to terminate in the first part of the right brachiocephalic vein.

A partial transposition of muscle fibers occurred in the diaphragm. The left crus was larger than the right, and the major openings, that is, the aortic, the vena caval and the esophageal, were transposed. The left leaflet of the central tendon was the largest, the right the smallest and the middle intermediate.

The Abdomen: The abdominal portion of the esophagus measured 3 cm. in length. The stomach was unusually large, measuring 20 cm. from the pyloric to the fundic border and lay, reversed in position, in the right hypochondrium and the epigastric areas. An extensive collateral circulation was established by the splenic, right gastric and right gastroepiploic arteries. The duodenum, although transposed, was normal in shape and curvature. It had a free superior portion and a fixed descending and transverse portion, and the pyloric sphincter appeared normal. The superior mesenteric artery was anterior to the uncinate process of the pancreas, showing that the mechanism of rotation of the head of the pancreas was comparable to the normal rotation. The root of the mesentery was

transposed, running obliquely downward from right to left. The terminal portion of the ileum was fixed for a distance of 9 cm., and the cecum and appendix were fixed in a retroperitoneal position, the appendix being in a subhepatic position on the left side of the body (Fig. 3). The ascending, transverse and descending portions of the colon were transposed but otherwise normal in attachment. The sigmoid flexure had a short mesentery, and the rectum was disposed in its usual manner, although transposed. The great omentum was very large, measuring 20 cm. from the greater curvature of the stomach to the distal free border and 30 cm. in the transverse plane (Fig. 2), and enclosed an extensive omental bursa. The liver and pancreas were transposed but normal in size and shape. The bile tract measured 12 cm. in length. The hepatic trunk was 4 cm. long and received two branches from the left hepatic lobe and one from the right hepatic lobe. The cystic duct was 4 cm. long. The common bile duct was 7 cm. long and passed to the dorsal surface of the duodenum to join with the main pancreatic duct. An accessory pancreatic duct was present 2.5 cm. above and somewhat lateral to the main duct. The portal system was formed by the superior mesenteric vein and the splenic vein. Coronary veins entered the portal vein near the porta hepatis. The inferior mesenteric vein joined the superior mesenteric vein just distal to its union with the splenic vein. The spleen was on the right side. It was 7 cm. wide and 10.5 cm. long, having the general shape of an orange segment. The kidneys were normal in shape and size. The right kidney was higher than the left, and each kidney was supplied by two renal arteries. The right kidney was drained by one renal vein and the left by two. The ureter of each kidney coursed downward over the external iliac vessels and entered the bladder in normal fashion. The vas deferens crossed anterior to the ureter on both sides in each case, and the superior vesical arteries were anterior to the ureters. The urinary bladder was normal. The suprarenal glands were transposed, the right being semilunar and the left triangular. The left gland was encroached upon by three large lymph nodes of the superior mesenteric group. The celiac ganglions were normal and received the greater splanchnic nerves. The testes were normal, the right testis being slightly lower in the scrotum than was the left.

In general, the abdominal blood supply was within normal limits. Variations in supply to the duodenum and pancreas were interesting but not unusual. The inferior pancreaticoduodenal artery was unique. Normally the arteries to the small intestine arise from the right side of the superior mesenteric arteries while those to the large bowel arise from the left side. The inferior pancreatic duodenal artery in the normal person usually arises from the right side also. In this subject with situs inversus it arose from the right side of the superior mesenteric artery, crossing dorsal to it to reach the left side and anastomose with the superior pancreatic duodenal artery. This suggests that rotation of the intestine, in this

Fig. 2—Dissection to show transposition of heart and aortic arch to right side, liver to left and stomach to right. *A*, lesser omentum; *B*, great omentum; *C*, stomach; *D*, transverse colon; *E*, pylorus; *G*, transposed right gastroepiploic artery; *H*, anterior epiploic arteries, and *I*, transposed right epiploic artery. *SCL*, transposed left subclavian artery; *CC*, common carotid; *LB*, brachioecphalic artery.

subject, occurred proximal to the point of origin of the inferior pancreatic duodenal artery instead of distal to it.

The Back: The muscles of the back were normal in orientation, number, blood and nerve supply. Dissection of the spinal cord revealed no abnormality in the structure of the cord. The number and distribution of the spinal nerves were normal. Roentgen examination of the cervical, thoracic, lumbar and sacral areas of the vertebral column was carried out. Anteroposterior projections revealed no anomalies or supernumerary vertebrae.

Observations.—This includes 3 cases of situs inversus in newborn infants with malformations incompatible with life.

CASE 1.—In a Negro girl who lived fifty-eight minutes, the postmortem findings were as follows: Situs inversus viscerum totalis was present. Absence of the right side of the diaphragm was observed, with massive herniation of the stomach, spleen, right lobe of the liver and all of the small intestine and the ascending colon into the right hemithorax, with subsequent herniation of the spleen and stomach through the posterior mediastinum (between the descending aorta and the esophagus) into the left hemithorax, but without perforation of the mediastinal pleura. There was malrotation of the intestines. Hypoplasia of the lungs was present, with massive atelectasis. Cor biloculare with a rudimentary interatrial septum primum, a bifid aortic valve, a double superior vena cava and pelvic ectopy of the right kidney were present, as was uterus unicornis with complete absence of the upper part of the right mullerian system and attachment of the right gonad to the right inguinal ligament of the mesonephros.

CASE 2.—A Puerto Rican boy who died at the age of 16 days was examined postmortem. Situs inversus viscerum totalis was present, with tricuspid atresia and stenosis of the tricuspid valve. Stenosis of the pulmonary artery and a patent ductus arteriosus were noted. Interatrial and interventricular septal defects were present. There was focal pulmonary atelectasis, bilateral.

CASE 3.—A Negro girl whose age at death was 4 days revealed, at autopsy, partial situs inversus. The stomach, duodenum, liver, biliary system, spleen and pancreas were transposed. There was malrotation of the colon with the cecum and appendix on the right side; duodenal stenosis and duodenojejunal obstruction due to bands were observed. A urachal cyst was present, and there was bilateral focal pulmonary atelectasis. A gastrojejunostomy had been performed and evisceration had occurred ten days after the operation.

Family histories for these infants were unavailable. Two of them were born out of wedlock and the third to parents who were unable to supply sufficient information.

COMMENT

Unfortunately no information is available with regard to the state of health of the cadaver specimen prior to death. Apparently he did not suffer from Kartagener's syndrome; the lungs and paranasal sinuses appeared normal, although the sinuses exceeded normal limits in several respects. The heart and great vessels appeared normal, with the exception of the aortic aneurysm. This, however, was an aneurysm of the saccular type, which, according to Kampmeier (1946), is almost always of syphilitic origin. Our conclusion is that this subject had had no defect that could be associated with the transposition of viscera.

Turning to the newborn infants, we have 3 striking examples of the coupling of situs inversus with defects of such magnitude that survival is impossible or measured in days. The first subject was born prematurely, with consequent cerebral damage; so many defects were present, however, that death would undoubtedly have occurred anyway; the heart defects, great vessel defects, or the herniation and malrotation of the intestines—any one of these was sufficient to cause death within a few days. In the second case multiple cardiac and great vessel defects existed. Stenosis of the artery and tricuspid valve and the interatrial and interventricular defects were each serious enough to result in death. In the third

case the thoracic viscera were in the normal positions, but the stomach, duodenum, liver, and pancreas were reversed, with malrotation of the colon. The major defect accompanying this partial inversion was duodenal stenosis requiring surgical intervention. Ten days after a gastrojejunostomy evisceration occurred, and with pulmonary and pericardial effusions and acute fibrinous peritonitis death resulted. The occurrence of this syndrome of critical congenital defects and situs inversus may be much higher than reports in the literature would indicate. At Jefferson Medical College Hospital the occurrence is 1:5,000; records are not complete, however, and there may have been additional cases among stillborn infants and those who died in the neonatal period that were not subjected to postmortem examination. Tanner-Cain and Crump (1951) have reported 3 cases of situs inversus with multiple congenital anomalies which are worth recounting. All 3 patients were Negro female infants. The first lived three days, and autopsy revealed levocardia accompanied by aortic compression, due to a displaced thymus; endocarditis; infarction of the heart and lungs; urethral atresia, and bilateral polycystic kidneys. The second infant lived fifteen days. Postmortem examination showed complete situs inversus, interatrial and interventricular septal defects with right-sided hypertrophy and dilation of the heart, bilateral atelectasis and anoxia. The third infant survived eleven months, and she too had complete situs inversus. Autopsy revealed chronic tracheobronchitis, atelectasis, a widely patent foramen ovale and bilateral hydronephrosis and hydroureters. The authors give no indication of occurrence; however, it is interesting to note that all three infants were Negro and female, particularly since in 2 of our own cases those facts also applied. Bauer (1947) has also reported 2 cases of this syndrome. The first infant had dextrocardia accompanied by hydrocephalus, cleft palate and a diaphragmatic hernia. The other had complete transposition with anencephalus, rachischisis, eventration of the viscera and clubfoot. Walls (1942) has reported a case in which only the heart and liver were reversed. The patient, a white female infant, died at the age of 6 months and was shown to have cor biloculare, with a markedly anomalous arrangement of the great veins. These cases are proof that any congenital defect is possible in conjunction with visceral transposition, two or more body systems commonly being affected. A number of other reports of this kind are included in the literature, but since they do not embody any symptoms not already mentioned we shall forego discussing them.

The frequent association of cardiovascular malformations with situs inversus presents important problems for the thoracic surgeon. Schmutzer and Linde (1958) reported an incidence of 25 per cent in cases of isolated dextrocardia and 8 per cent in cases of situs inversus viscerum totalis. Campbell and MacCarthy (1957), in an eight-year study at Guys Hospital, London, saw 46 patients with congenital heart disease and some form of transposition. Twenty had isolated dextrocardia; 16 had isolated levocardia, and 10 had situs inversus viscerum totalis. Only two cases of situs inversus without congenital heart disease were observed in the entire course of this study. Rosenberg and Rosenberg (1949) reported a case of situs inversus with coronary heart disease. In their review of the literature they made the interesting discovery that the combination of acquired heart disease and dextrocardia is very rare. Why this should be is difficult to say, unless it is because congenital defects mask the appearance of acquired disease or, in many cases, cause death before disease normally occurs. This is a problem that needs further study.

It is interesting that dextrocardia occurs in two forms. One type is a complete mirror image, with heart chambers and great vessels transposed; the other type is merely a rotation of the heart so that the apex comes to lie to the right. Unfortunately, many authors fail to make this distinction, so that the incidence of the two types can not be stated with any degree of accuracy. A study by Lowe and McKeown (1954), however, permits some estimation to be made. In a painstaking survey these investigators recorded 10 cases of isolated dextrocardia in a period during which 293,000 live births occurred, as well as 20 cases of dextrocardia with situs inversus (1:7,000), as a consequence of mass radiographic surveys. Of the cases of isolated dextrocardia, there were mirror-image inversions in 5 and rotated hearts with normal arrangement of the chambers and vessels in 4; in 1 the condition was of an unknown type. Of these 10 subjects only 3 were free of cardiac malformations; nevertheless, 1 of these 3 died, shortly after birth, of other gross malformations. The other 7 had severe cardiac malformations with cyanosis and, in addition, 4 of the 7 had pulmonary atresia. Preceding this report, a survey by McKeown, MacMahon and Parsons (1953) provides interesting supplemental data. They tried to collect all cases of congenital heart disease in children born in Birmingham, England, during a ten-year period. Six hundred and thirty-three cases were recorded, including 7 cases of dextrocardia. In 2 of the cases of dextrocardia there were visceral transposition and bronchiectasis; in 4, gross cardiac defects, death resulting in 3. The fifth child, although free of cardiac abnormalities, died shortly after birth as a result of other malformations.

These two reports probably reflect quite accurately the incidence of dextrocardia and of associated cardiac malformations, as well as the resulting mortality rate.

In the majority of cases, visceral transposition is discovered during roentgen examination. In some cases, however, it was missed by unthinking reversal of plates during examination, with consequent embarrassing discovery of the condition during operation. A thoracic roentgenogram will permit a tentative diagnosis of dextrocardia, the extent of inversion being determined by abdominal roentgen examination. Reports of this kind from the armed forces are valuable for estimating the incidence of situs inversus in normal healthy young men. Caplan (1946) found 12 cases of dextrocardia, which proved to be situs inversus viscerum totalis, during Naval enlistment examinations. The incidence was 1:8,400, and all 12 subjects were in good health. Richman (1947) reported 3 similar cases from examination at the Army Hospital, Richmond, Virginia. The incidence here was 1:5,000, all 3 persons again being in good health.

From a clinical standpoint, defects of the respiratory system are probably the most important of all the viable defects that accompany situs inversus. Kartagener (1933), in a report of 4 cases, was the first to describe the triad of situs inversus, bronchiectasis and chronic sinusitis. Subsequently, Kartagener and Horlacher (1935) reported 6 additional cases. In 1938 Adams and Churchill reported 5 cases from Massachusetts General Hospital. This included approximately 22 per cent of the cases of situs inversus observed in this hospital in a period dating back to 1886. Olsen (1943) reviewed 85 patients with dextrocardia and found that 16.5 per cent (14 patients) had bronchiectasis, in contrast to a 0.5 per cent incidence of bronchiectasis among all patients at the Mayo Clinic. Olsen also expressed the opinion that in most cases bronchiectasis is acquired. An additional observation was that 11 of the 85 patients in this study had additional anomalies, including congenital heart disease, hydrocephalus, im-

perforate anus, cleft palate, flail thumb and accessory digits. Torgersen (1947) observed bronchiectasis and nasal polyps in 10 per cent of the persons with situs inversus whom he studied. He reported that the frontal sinuses were small in cases of situs inversus associated with bronchiectasis and of average size in cases of situs inversus without bronchiectasis. A strong pattern of inheritance is indicated by the fact that Torgersen (1950 A, 1952) noted a 25 per cent incidence of bronchiectasis and nasal polyposis among 77 siblings of 28 persons with Kartagener's syndrome, while among 496 siblings of 93 persons with situs inversus alone there were only 3 with nasal polyps and none with bronchiectasis. In 1949, on the basis of a larger number of cases, Torgersen reported a 25 per cent incidence of bronchiectasis in persons with situs inversus. Schmutzer and Linde (1958) estimated the incidence of bronchiectasis in persons with situs inversus totalis or dextrocardia at 12-23 per cent, in contrast to an incidence of bronchiectasis in the hospital population of 0.03 to 0.5 per cent. The authors cited reported that bronchiectasis accompanying situs inversus is tubular rather than cystic and, in most cases, the acquired type of the disease.

Whether the bronchiectasis accompanying situs inversus, or any bronchiectasis, is acquired or congenital is difficult to say. The following reports seem to indicate that in a high percentage of cases of Kartagener's syndrome the bronchiectasis is congenital.

Bergstrom and others (1950), in a study of the familial occurrence of Kartagener's syndrome, reported 2 cases of Kartagener's triad and 2 cases of bronchiectasis among the 6 children of one family. They emphasized the fact that this syndrome is a pediatric problem, since they had collected 13 cases from the literature in which it was recognized before the subjects were 2 years of age and 10 more in which children under 14 years of age were affected. Five more cases of Kartagener's syndrome in children have been reported by Dickey (1953). In 1 of these cases the condition was diagnosed when the child was 6 weeks of age; death due to cardiac defects occurred at the age of 14 months. Three other children, aged 9, 10, and 14 respectively, underwent lung resection, and the fifth child, aged 4, was awaiting surgical intervention.

It is our opinion that in most, if not all, cases bronchiectasis has a congenital basis. In the development of the lungs immature bronchial pouches are formed, which are often devoid of elastic or muscular tissue. The major factor in the development of these pouches, which are susceptible to dilation, is the mechanical obstruction of the developing lung by surrounding tissue.

Fig. 3.—Dissection to show fixed terminal portion of ileum and cecum with subhepatic appendix on left side. Note large size of stomach, which has been turned upward. *A*, appendix; *B*, fixed ileum; *C*, cecum; *D*, transverse colon; *E*, ureter crossing external iliac artery, and *F*, small intestine.

This theory gains support from the fact that the lobes and segments of the lungs adjacent to the heart are invariably involved in bronchiectasis. Foulk (1957) has presented a case of Kartagener's syndrome in which this is particularly well illustrated. It seems logical to suppose that the factor of mechanical obstruction is greatly increased in cases of dextrocardia, since the lungs would remain in their normal position. To prove this and other assumptions, future reports must be more detailed. Quite frequently no mention is made of age or sex or race, and it is also common to speak of situs inversus without specifying the degree of inversion.

Wood and Blalock (1940) have reviewed the literature on situs inversus totalis and diseases of the biliary tract. They reported a total of 18 cases, including a case of their own, and concluded that the incidence of disease of the biliary tract is no higher than in the general population. The localization of pain in these persons is interesting. Eleven had pain in the left upper abdominal quadrant and the back; 2 on the right side, and 3 in the epigastrium. In 2 cases the information was not available. This is in marked contrast to the location of referred pain in the person with situs inversus and appendicitis. DePol (1935) collected 46 cases from the literature and noted that more than half of these had pain on the right side; unfortunately, in only 7 of these cases was the correct diagnosis of situs inversus made before the operation.

Almy, Volk and Graney (1953) presented a case of right-sided stomach in which all other viscera were in their normal positions. Kelley (1955) reported 2 cases of transposed stomach in 115,464 hospital admissions, in 1 of which diaphragmatic eventration occurred. In these extremely rare cases the stomach, the duodenum and the first part of the jejunum were transposed. In relation to transposition of the stomach, the condition of the pylorus is of considerable interest. Although the data are meager, there are nevertheless definite indications that the arrangement of the musculature at this site may be abnormal. Pernkopf (1926) reported 3 cases of stomach inversion, in 2 of which there was absence of the pyloric sphincter, with no differentiation of the musculature in this region. In contrast, the patient in the third case exhibited thick pyloric musculature. Greenblatt (1935) reported a case of congenital duodenal atresia in a 4-day-old white boy with complete transposition of the viscera. Of considerable interest is the fact that the infant was the surviving member of a set of twins, and unfortunately no data were given concerning the stillborn member. It should be recalled that in 1 of our 3 cases of infantile situs inversus pyloric stenosis was also the critical factor in causing death. Since pyloric stenosis is due to a recessive gene, with some reduction of penetration in the males but much more in the female (Snyder, 1946), a critical study of its occurrence and association with situs inversus is in order.

Torgersen (1948 and 1949) related another interesting association, which to our knowledge has been observed by only one other investigator. Of 56 cases of situs inversus observed by Torgersen, the patients in 23 per cent had either six lumbar vertebrae or lumbosacral vertebrae. He examined 61 parents and siblings and 500 normal situses for comparison and noted the incidence of these variations to be 5 per cent and 7.6 per cent respectively. This study strongly suggests a correlation between situs inversus and vertebral anomalies. The other report of this type (Pichel Warner, 1956) concerned a case of abdominal situs inversus in a 22-year-old white soldier. Roentgen examination of this patient revealed a failure of segmentation of the fifth lumbar and first sacral vertebrae. Interesting too, in this respect, is a report

of costal anomalies coupled with situs inversus (Chenebault and Le Pape, 1956).

Situs inversus is a condition of reversed asymmetry which, judging from the diverse sources of information, occurs in all races and nations. Unfortunately, the reports are not always precise enough to allow classification into the several different types of inversion that may occur. Because of this, and also because many cases are overlooked, in routine examination an accurate survey of the incidence and the relation to pathologic change is difficult. Several problems are particularly important, such as the occurrence of situs inversus in stillborn infants and in children who die soon after birth. In this respect it would be extremely simple to observe the umbilical cord in all births, since Cleveland (1926) has stated that it is wound spirally to the right instead of to the left, as it leaves the placenta, in cases of inversion. Mass thoracic roentgen studies should include observations on dextrocardia and follow-up examinations to establish the type of dextrocardia and the completeness of inversion. The tangled evidence related to the cause of visceral inversion could be greatly clarified by simple interviews with groups of affected persons. Twinning and monster formation, if studied properly, will also provide valuable clues to this problem. In the course of routine physical examination, evidence could be gathered as to the incidence of situs inversus, since the respective height of the testes is also tentatively diagnostic, the right testis being lower than the left. In these cases the disposition of crown whorl has not been thoroughly investigated, and, while handedness apparently is not a factor, it too should be considered in examination. Finally, Kartagener's syndrome and the syndrome of atrioventricularis communis, agenesis of the spleen and situs inversus should be subject to thorough study.

SUMMARY

Four cases of situs inversus are presented and discussed. In the first the condition was observed in a cadaver specimen dissected at Jefferson Medical College. A detailed account of this dissection is given. The other 3 cases, observed at Jefferson Medical College Hospital, are examples of situs inversus with associated multiple defects, resulting in early death.

The incidence of situs inversus totalis is estimated as between 1:5,000 and 1:10,000. The various degrees of situs inversus, which occur less frequently, are listed, and their occurrence in the general population and in hospital populations is mentioned. The literature is reviewed and analyzed from a number of standpoints. First, the genetic and embryologic studies relating to this condition are presented, and a hypothesis regarding the cause of situs inversus is given. It is suggested that situs inversus is the result of either genetic or developmental factors. In the first instance a single autosomal recessive gene with incomplete penetration is responsible. This gene is partially lethal. In the second a developmental arrest, due to any of a variety of causes, results in fission at an early stage. This occurs after bilateral symmetry is established and results in mirror-image monozygotic twins, either of whom may die and be resorbed at an early age.

The relation of situs inversus to a host of pathologic conditions is pointed out. These conditions include Kartagener's syndrome (bronchiectasis, sinusitis and situs inversus); the syndrome of atrioventricularis communis; agenesis of the spleen with partial situs inversus, and a syndrome of multiple congenital defects accompanying situs inversus and resulting in early death of the newborn infant. The association of other defects with situs inversus is also discussed.

Methods of detecting situs inversus are

reviewed, and it is suggested that greater care be exercised to insure recognition of this condition at an early age. The value of adequate surveys and accurate classification is stressed. In particular, mass thoracic roentgen studies should be reviewed for possible dextrocardia. The patients should be reexamined to determine the degree of transposition, the presence or absence of associated defects and the occurrence of similar conditions in related persons.

ZUSAMMENFASSUNG

Vier Fälle von Situs inversus werden vorgestellt und erörtert. Die erste Beobachtung wurde bei einer Obduktion im Jefferson Medical College, über die genau berichtet wird, gemacht. Bei den anderen drei Fällen aus dem Jefferson Medical College Hospital handelt es sich um Beispiele von Situs inversus mit vielen gleichzeitig bestehenden Defekten, die zu frühem Tode führten.

Die Häufigkeit des totalen Situs inversus wird auf zwischen 1:5000 und 1:10000 geschätzt. Die verschiedenen Grade des Situs inversus, die seltener vorkommen, werden aufgeführt, und die Häufigkeit ihres Auftretens unter der allgemeinen Bevölkerung und unter Krankenhausinsassen wird erwähnt. Das Schrifttum wird überprüft und von verschiedenen Standpunkten aus analysiert. In erster Linie wird über die entwicklungsgeschichtlichen und embryologischen Untersuchungen bezüglich dieser Fehlbildung berichtet; ferner wird eine Hypothese für die Ursache des Situs inversus aufgestellt. Es wird angenommen, dass der Situs inversus das Ergebnis entweder genetischer oder entwicklungsmässiger Faktoren ist. Im ersten Falle ist ein einzelnes autosomes rezessives Gen mit unvollständiger Penetration verantwortlich. Dieses Gen ist teilweise ein lethaler Faktor. Im zweiten Falle führt ein Entwicklungsstillstand, der als Folge einer von mannigfachen Ursachen eintritt, zur Spaltung in einem frühen Stadium. Dies erfolgt nach Herstellung der Symmetrie beider Seiten und führt zur Entstehung eineiiger Spiegelbildzwillinge, von denen einer zugrunde gehen und im frühen Stadium resorbiert werden kann.

Es wird auf die Beziehung des Situs inversus zu einer grossen Menge von krankhaften Veränderungen hingewiesen. Zu diesen gehören das Kartagenersche Syndrom (Bronchiektasen, Sinusitis und Situs inversus), das Syndrom der Vereinigung von Herzkammern und -vorhöfen, Aplasie der Milz mit teilweisem Situs inversus und ein Syndrom mehrfacher angeborener Defekte, die mit Situs inversus vergesellschaftet sind und zum frühen Tode des Neugeborenen führen. Auch andere Missbildungen, die bei Situs inversus vorkommen, werden erörtert.

Die Methoden zur Entdeckung des Situs inversus werden dargestellt, und zu grösserer Sorgfalt zur Erkennung dieser Fehlbildung im frühen Lebensalter wird geraten. Der Wert angemessener Untersuchungen und genauer Klassifizierung wird hervorgehoben. Besonders sollten die Ergebnisse der röntgenologischen Reihenuntersuchungen des Brustkorbs nachgeprüft werden, um den Grad der Transposition, das Bestehen oder Fehlen vergesellschafteter Defekte und das Vorkommen ähnlicher Zustände bei Familienmitgliedern zu erkennen.

RIASSUNTO

Vengono presentati e discussi quattro casi di situs inversus. Nel primo l'anomalia si presentó alla dissezione anatomica eseguira al Jefferson Medical College, che viene riferita per esteso. Gli altri tre casi, osservati al Jefferson Medical College Hospital, sono esempi di situs inversus associato ad altre anomalie che condussere ad una morte precoce. La frequenza sel situs inversus totale e' valutata fra 1:5000

e 1:10000. I gradi intermedi, che si presentano con minor frequenza, vengono descritti e viene indicata la loro frequenza nella popolazione generale e in quella ospedaliera. Viene fatta una rassegna della letteratura sotto molti punti di vista. Dapprima vengono riferiti gli studi genetici ed embriologici in rapporto con l'affezione, e riassunte le ipotesi causali. Il situs inversus sarebbe il risultato di fattori genetici e di sviluppo; nel primo caso sarebbe responsabile un unico gene autosomico recessivo con incompleta penetrazione; questo gene sarebbe parzialmente letale. Nel secondo caso si tratterebbe di un arresto di sviluppo dovuto ad una qualche causa, e producente una fissione in uno stadio precoce. Questo dovrebbe verificarsi dopo che si e' stabilita la simmetria bilaterale e conduce alla formazione di gemelli monozigoti fatti a immagine speculare, uno dei quali puo' morire e riassorbirsi ad un epoca precoce.

Vennono trattati i rapporti fra il situs inversus e le malattie. Queste, comprendono la sindrome di Kartagener (bronchiettasia, sinusite e situs inversus), la sindrome della cavita' atrioventricolare comune, la agenesia della milza con parziale situs inversus e la sindrome di associazione di anomalie multiple con situs inversus che conduce rapidamente a morte il neonato.

Vengono passati in rassegna i metodi per la diagnosi dell'affezione e soprattutto per il suo riconoscimento in una eta' giovane. In particolare vengono raccomandati gli esami radiologici collettivi, e il riesame dei casi per determinare il grado di trasposizione, la presenza o l'assenza di anomalie associate e la eventuale presenza della stessa affezione nei famigliari.

RÉSUMÉ

Quatre cas de situs inversus sont présentés et discutés. Le premier cas a été observé sur un cadavre au cours d'une dissection au Jefferson Medical College Hospital, et les auteurs en donnent un compte-rendu détaillé. Les trois autres cas, qui proviennent du même hôpital, sont des exemples de situs inversus associé à d'autres affections multiples ayant provoqué une mort prématurée.

Il est estimé que l'incidence du situs inversus totalis varie entre 1:5.000 et 1:10.000. Il peut se présenter à des degrés variables qui sont mentionnés ici, mais plus rarement. Les auteurs donnent des chiffres quant à leur fréquence parmi la population et parmi les hospitalisés, analysent la littérature sous divers aspects, et étudient le situs inversus du point de vue génétique et embryologique. Cet état pourrait être dû à des facteurs soit génétiques soit de croissance. Dans le premier cas il faudrait mettre en cause un gène autosome récessif à pénétration incomplète, partiellement asphyxié; dans le second cas, un arrêt de croissance (plusieurs causes possibles) provoque une fission à un stade précoce. Cela se produit après l'établissement de la symétrie bilatérale (jumeaux monozygotiques, dont l'un ou l'autre peut mourir et être résorbé précocement).

Les rapports entre le situs inversus et un hôte pathologique sont décrits. L'auteur mentionne les états suivants: syndrome de Kartagener (bronchiectasie, sinusite et situs inversus); syndrome atrioventriculaire; agénésie de la rate avec situs inversus partiel; syndrome de lésions multiples congénitales accompagnant le situs inversus, conduisant à la mort du nouveauné. L'association d'autres lésions avec le situs inversus est également discutée.

Les méthodes de diagnostic sont énumérées et il est recommandé d'attacher une plus grande attention à la reconnaissance de cet état à un stade précoce. L'importance d'examens complets et d'une classification judicieuse des cas est soulignée. En particulier les examens radiographiques en série devraient être repris et

étudiés à nouveau afin de déterminer si possible le degré de transposition, la présence ou l'absence de lésions associées, ainsi que l'éventualité d'un état familial.

RESUMEN

Se presentan y discuten 4 casos de transposición visceral. El primero de estos casos fué observado en un cadáver desecado en el Jefferson Medical College. Se da un completo informe de este caso. Los otros 3 casos observados en el J.M.C. son ejemplos de la misma enfermedad con múltiples defectos asociados que conducen a una muerte rápida.

La frecuencia de la transposición visceral se estima entre 1:5.000 y 1:10.000. Los diversos casos de transposición visceral que pueden presentarse con menos frecuencia son enumerados así como se menciona su aparición en la población en general y en la población hospitalaria. Se hace una revisión completa de la literatura sobre esta cuestión. Se estiman a continuación las condiciones genéticas y embriológicas así como la hipótesis concerniente a los casos de situs inversus. Se sugiere que el situs inversus es el resultado de factores genéticuos o del desarrollo.

En el primer caso el responsable sería un gene recesivo autosomático solo con penetración incompleta. Este gene se parcialmente letal. En el caso segundo una parada en el desarrollo consecutiva a una o varias causas resultaría en una fisión en un estadio precoz. Esto ocurre después de que la simetría bilateral ha sido establecida y teniendo como consecuencia unos gemelos monocigóticos en imagen de espejo, uno de los cuales moriría y sería precozmente reabsorbido.

También se indica la relación en un situs inversus con un hesped de condiciones patológicas. Estas condiciones incluyen el síndrome de Kartagener (bronquiectasias, sinusitis e inversión visceral), el síndrome de atrioventricularis comunis; la agensia del bazo con situs inversus que trae como consecuencia la muerte precoz del recién nacido. Se exponen diversos métodos de diagnóstico de las inversiones viscerales y se insiste en el gran cuidado que es necesaria para reconocer esta afección lo antes posible. Particularmente interesan los estudios cuidadosos del tórax para determinacos casos de transposición. La presencia o ausencia de defectos concomitantes y la aparición de condiciones semejantes en los familiares.

SUMARIO

Apresentam e discutem quatro casos de situs inversus. O primeiro foi descrito pós mortem em necropsia feita no Jefferson Medical College. Os outros 3 são exemplos de situs associados con defeitos multiplos resultando em morte precoce.

Estima a incidência em 1:5.000 a 1:10.000. Cita os varios graus que ocorrem menos frequentemente. Fazem a revisão da literatura e analisam varios aspectos. Apresentam inicialmente os aspectos geneticos e os estudos embriologicos dando uma hipotese causal. Sugerem que o situs inversus é o resultado de fatores geneticos ou de desenvolvimento. No primeiro caso existe um gen recessivo autosomatico com penetração incompleta. Este gen é parcialmente letal. No segundo há umaparada do desenvolvimento devida a uma variedade de causas. Isto ocorre apos a simetria bilateral e resulta numa imagem de espelho em gemeos monozigotos um dosquais morre e é reabsorvido no estagio inicial. Salienta a correlação entre o situs e as alterações patologicos como a sindrome de Kartagener (bronquiectasias, sinusite e situs inversus) agenesia do baço e situs parcial e uma sindrome de multiplos defeitos congenitos que resultam na morte do recemnascido. A associação de outros defeitos com o situs tambem é discutida. Fazem a revisão dos metodos

proprios para reconhecer a anomalia precocemente e apresentam os criterios para uma classificação. Citam o censo toracico que deve ser reexaminado para determinar o grau de transposição, a presença ou ausência de defeitos associados e a ocorrencia de situaçõessemelhantes em familiares.

BIBLIOGRAPHY

Adams, R., and Churchill, E. D.: Situs Inversus, Sinusitis and Bronchiectasis, J. Thoracic Surg. **7**:206, 1937.

Aird, I.: The Conjoined Twins of Kano, Brit. M. J. **1**:831, 1954.

Almy, M. A.; Folk, F. N., and Graney, C. M.: Situs Inversus of Stomach, Radiol. **61**:376, 1953.

Bauer, K. F.: Eine Reihe seltener lageanomalien im bauch—und brustsitus menschlicher neugeborener, Anat. Anz. **96**:253, 1948.

Bergstrom, W. H.; Cook, C. C.; Scannell, J. G., and Berenberg, W.: Situs Inversus, Bronchiectasis and Sinusitis; Report of a Family with Two Cases of Kartagener's Triad and Two Cases of Bronchiectasis among Six Siblings, Pediatrics **6**:573, 1950.

Campbell, M., and MacCarthy, D.: Morbus Caeruleus with Inversion of the Abdominal Viscera in Two Cousins, Guy's Hosp. Rep. Lond. **106**:18, 1957.

Caplan, S. M.: Visceral Transposition with Dextrocardia; Report of Eight Cases with Review of Literature of Dextrocardia, U.S. Navy M. Bull. **46**:1011, 1946.

Chenebault, J., and Le Pape, J.: Sur un cas de syndrom de Kartagener associe a des anomalies castales et a une tuberculase pulmonare, Maroc. Med. **35**:45, 1956.

Cleveland, M.: Situs Inversus Viscerum: An Anatomic Study, Arch. Surg. **13**:342, 1926.

Cockayne, E. A.: The Genetics of Transposition of Viscera, Quart. J. Med. **7**:479, 1938.

De Pol, G.: Appendicite sinistra per "situs viscerum inversus" con localizzazione clinica a destra, Gaz d. osp. **54**:1243, 1933.

Dickey, L. B.: Kartagener's Syndrome in Children, Dis. Chest **23**:657, 1953.

Foulk, R.: Kartagener's Syndrome, U.S. Armed Forces M. J. **8**:279, 1957.

Gates, R. R.: Human Genetics. New York: The MacMillan Company, 1946, p. 906.

Gould, D. M.: Non-Tuberculosis Lesions Found in Mass X-ray Surveys, J.A.M.A. **127**:753, 1945.

Goncerzewicz, M.: Rzadki przypadek wrodzonef brokn Sledziony i wrodzonef wady serca, 3 Calkowitym odwrotnym ukladem trzew, Polski Tygod. lek. **12**:1785, 1957.

Greenblatt, A.: Congenital Duodenal Atresia with Complete Transposition of the Viscera, Brit. Med. J. **2**:840, 1935.

Hamburger, V.: A Manual of Experimental Embryology. Chicago: The University of Chicago Press, 1942, p. 70.

Hummel, K. P., and Chapman, D. B.: Visceral Inversion and Associated Anomalies in the Mouse, J. Hered. **50**:9, 1959.

Johnson, J. R.: Situs Inversus with Associated Abnormalities: Review of the Literature and Report of Three Cases, Arch. Surg. **58**:149, 1949.

Kampmeier, R. H.: Diagnosis and Treatment of Cardiovascular Syphilis, Clinics **5**:135, 1946.

Kartagener, M.: Zur Pathogenese der Bronchiektasien; Bronchiektasien bei Situs viscerum inversus, Beits. 2. Klin. d. Tuberk. **83**:489-501, 1933.

Kartagener, M., and Horlacher, A.: Bronchiektasien bei Situs Viscerum inversus, Schweiz. Med. Wchnschr. **65**:782, 1935.

Keeler, C. E.: On the Amount of Mirror-Imaging in Double Monsters and Identical Twins, Proc. Nat. Acad. Sci. **15**:839, 1929.

Kelley, R. W.: Transposition of the Stomach: Report of Two Cases, Gastroenterol. **29**:295, 1955.

Komai, T.: Problem of Situs Inversus Viscerum as Studied on Single and Duplicate Salmon Embryos, Mem. College Sc. Kyoto Imp. Univ., Series B, **14**, 1938.

Leiniger, C. R., and Gibson S.: Transposition of Viscera in Siblings, J. Pediat. **37**:195, 1950.

Lowe, C. R., and McKeown, T.: Dextrocardia With and Without Transposition of Abdominal Viscera, with Report of Case in One Monozygotic Twin, Ann. Eugen. **18**:267, 1954.

Lutz, H.; Chambroux, S., and Lutz-Ostertag, Y.: Twin Formation and Situs Inversus Viscerum in the Embryo of the Trout, Acta Genet. Med. (Roma) **6**:493, 1957.

Mayo, C. W., and Rice, R. G.: Situs Inversus Totalis; Statistical Review of Data on Seventy-Six Cases, with Special Reference to Diseases of the Biliary Tract, Arch. Surg. **58**:724, 1949.

McKeown, T.; MacMahon, B., and Parsons, C. G.: The Familial Incidence of Congenital Malformations of the Heart, Brit. Heart J. **15**:273, 1953.

Newman, H. H.: The Question of Mirror-Imaging in Human One-Egg Twins, Human Biol. **12**:21, 1940.

Olsen, A. M.: Bronchiectasis and Dextrocardia, Am. Rev. Tuberc. **47**:435, 1943.

Pernkopf, E.: Der partielle Situs inversus der eingeweide beim Menschen, Ztschr. f. d. ges. Anat. **79**:577, 1926.

Pichel Warner, R. R.: Situs Inversus of the Gastro-Intestinal Tract, U. S. Armed Forces M. J. **7**:1521, 1956.

Polhemus, D. W., and Schafer, W. B.: Congenital Absence of the Spleen; Syndrome with Atrioventricularis (Communis) and Situs Inversus; Case Reports and Review of Literature, Pediatrics **9**:696, 1952.

Richman, S.: Dextrocardia with Complete Situs Inversus; Cases, Am. J. Roentgenol. **57**:616, 1947.

Rosenberg, H. N., and Rosenberg, I. N.: Simultaneous Association of Situs Inversus, Coronary Heart Disease and Hiatus Hernia; Report of Case and Review of Literature, Ann. Int. Med. **30**:851, 1949.

Schmutzer, K. J., and Linde, L. M.: Situs Inversus Totalis Associated with Complex Cardiovascular Anomalies, Amer. Heart J. **56**:761, 1958.

Snyder, L. H.: The Principles of Heredity. Boston: D. C. Heath and Co., 1946, p. 383.

Spemann, H., and Ruud, G.: Die Entwicklung isolierten dorsaler und lateraler Gastrulahaften

von Triton taeniatus, Arch. f. Entro' mech. 52:97, 1922.

Stockard, C. R.: Developmental Rate and Structural Expression: an Experimental Study of Twins, "Double Monsters" and Single Deformities and the Interaction Among Embryonic Organs During Their Origin and Development, Am. J. Anat. 28:115, 1921.

Tanner-Cain, N., and Crump, E. P.: Situs Inversus; Report of Three Cases and Review of Literature, J. Pediat. 38:199, 1951.

Terslev, E.: A Case of Agenesis of the Spleen, Congenital Heart Disease and Complete Situs Inversus, Acta paediat upps. 47:297-301, 1958.

Tihen, J. A.; Charles, D. R., and Sippel, T. D.: Inherited Visceral Inversion in Mice, J. Hered. 39:29, 1948.

Torgersen, J.: Familial Transposition of Viscera, Acta Med. Scand. 126:319, 1946.

Torgersen, J.: Transposition of Viscera, Bronchiectasis and Nasal Polyps, Acta Radiol. Stockholm 28:17, 1947.

Torgersen, J.: Anomalies of the Spine in Anomalies of the Viscera and Constitution, Acta Radio. Stockholm 29:311, 1948.

Torgersen, J.: Concordant Situs Inversus in Dizygotic Twins, J. Hered. 39:293, 1948a.

Torgersen, J.: Genic Factors in Visceral Asymmetry and in the Development and Pathologic Changes of Lungs, Heart and Abdominal Organs, Arch. Path. Chir. 47:566, 1949.

Torgersen, J.: The Developmental Anatomy of the Heart and the Etiology of Congenital Heart Disease, Acta Radiol. Stockholm 33:131, 1950.

Torgersen, J.: Situs Inversus, Asymmetry and Twinning, Am. J. Human Genet. 2:361, 1950a.

Torgersen, J.: Triad of Kartagener; Contribution to its Hereditary and Developmental Basis, Schweiz. Med. Wchnschr. 82:770, 1952.

Walls, E. W.: An Unusual Case of Congenital Cardiac Abnormality with Partial Situs Inversus, Anat. Rec. 82:497, 1942

Wood, G. A., and Blalock, A.: Situs Inversus Totalis and Disease of the Biliary Tract: Survey of the Literature and Report of a Case, Arch. Surg. 40:885, 1940.

By palpation we obtain further information about our patients' bodies through the sense of touch, and we also elicit certain reactions on their part, such as hyperaesthesia and tenderness. We are all accustomed from childhood to use our eyes, though the faculty of observation is acquired; but the sensation of touch varies enormously in its acuity from individual to individual. It is said that some cardsharpers can feel the pips on playing cards, and that burglars can trace the movements of the tumblers in a lock by sensing their fall. A highly developed tactile sense is part of the equipment of the skilled clinician; this we must strive to acquire by constant practice, by developing tactile discrimination, and by learning to recognize the feel of familiar and rare conditions by frequent contact. Such education is a matter of developing association tracts between the finger and the brain, as we speedily realize when we are forced by some accident to use an unaccustomed finger for rectal examination.

—*Ogilvie*

Certain Aspects of Tuberculosis of the Genitourinary Tract

Stones and Renal Tuberculosis; Puigvert's Operation for Tuberculosis of the Lower Portion of the Ureter

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Two cases are reported in which stones and renal tuberculosis coexisted. It was possible to save one kidney and obtain cure by conservative surgical intervention and medical therapy.

Etiologic problems as to the connection of this coexistence of stones and tuberculosis are discussed.

A case is presented in which Puigvert's operation was performed with success. The literature is reviewed as to the prerequisites, chances and limitations of this operation.

IT SHOULD be clear from the beginning that in mentioning about stones in connection with renal tuberculosis we do not mean calcifications of caseous matter but genuine calculi. Probably owing to the fortunate fact that infection with Koch's bacillus and subsequent morbidity is incomparably less frequent in the United States than in other countries, there is a paucity of papers on this subject.

Couvelaire and Brizon reviewed 765 cases of renal tuberculosis and noted that stones were present in 29, or close to 4 per cent. In their elaborate study they observed that 13 of these calculi were in the pyelocaliceal system, 4 in the ureter, 4 in the lower part of the genitourinary tract and 8 in the noninfected opposite kidney.

We have had an opportunity to observe 2 cases of calculi in a tuberculous kidney.

CASE 1.—C. B., a man aged 58, was admitted to the hospital on April 25, 1949.

This patient had first been seen in April 1949, when he was admitted for multiple sinuses on the scrotum. He was the child of Swiss parents, who had both died of "stroke." One sister had had pulmonary tuberculosis but is now cured. The patient himself had had tuberculosis of the right knee, which healed with ankylosis.

In 1944 "abscesses in both testicles" developed and had to be lanced by the family physician. Pus had drained from several sinuses off and on ever since. The patient also had be-

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come impotent. Four weeks prior to admission he suffered what was called virus pneumonia. Since the attack of pneumonia, however, he had had chills, fever and an increased flow of drainage from the sinuses on the scrotum.

His weight was 190 pounds (86.2 Kg.). He appeared well fed, with strong muscles, but the skin was pale. The temperature was 38.7 C. A blood count revealed 83 per cent hemoglobin.

There were 11,150 leukocytes per cubic millimeter of blood, with 73 per cent neutrophils, 25 per cent lymphocytes and 2 per cent large monocytes. The sedimentation rate was 18 mm. in one hour. Urinalysis revealed cloudy urine with a *p*H of 4.5 and a specific gravity of 1.022. There was a trace of albumin, but no sugar was present. Microscopically a few red blood cells, a moderate number of white blood cells and much amorphous matter were observed. Serologic tests gave negative results. Blood chemical values were normal; sugar, 90 mg. and urea nitrogen, 20 mg., per hundred cubic centimeters. The blood pressure in millimeters of mercury was 96 systolic and 90 diastolic.

The left knee was stiff, but otherwise there were no physical abnormalities except for the local signs and the hypotension, the latter of which, incidentally, changed to normal before the patient's discharge.

Local Signs.—There was a sinus, draining pus, on the left side of the scrotum. The left testicle was adherent to the scrotal skin and much enlarged. The area of the epididymis was remarkable for additional induration, but there was no line of cleavage between it and the testicle. The right testicle was normal in size and not tender. The epididymis was dense and thickened, and the skin was adherent. The right side was nodular, thickened and hard. There was also adherence of the scrotal contents to the skin at a point which seemed to be a thin scar.

Rectal Observations.—The prostate was flattened, had some soft spots and was not enlarged; no sulcus was palpable, and there was more than normal tenderness on palpation. The left seminal vesicle was hard, enlarged and tender.

Bacteriologic Data.—A smear from the scrotal sinuses revealed tubercle bacilli, as did a smear of the patient's urine.

Thoracic Study.—A roentgenogram of the chest showed spotty calcifications in both apical regions (healed tuberculosis).

Cystoscopic Study.—The anterior portion of the urethra was normal in the area of the verumontanum; the mucous membrane was velvety and bled readily on being touched with the instrument. There were fine miliumlike elevations suggestive of tubercles. There were numerous openings, giving the posterior urethra the appearance of a sieve. These, no doubt, were the scarry orifices of prostatic ducts. Digital examination by rectum over the indwelling cystoscope revealed the almost total absence of prostatic tissue, which may have been consumed by the tuberculous infection. The left seminal vesicle was hard and much enlarged. The right seminal vesicle was palpable, but much softer.

The bladder showed inflammatory granulations of no specific type in a small area below the left orifice. The rest of the organ presented increased vascularization, but the surface in general was normal, including the right ureteral orifice. Ureteral catheters, No. 5, were easily inserted to a distance of 26 cm. bilaterally. The specimen from the right side was clear; from the left drained cloudy urine.

Urinalysis.—The bladder urine showed only acid-fast bacilli; the renal urine in ordinary culture showed no growth.

Roentgen Examination.—A pyelogram was taken after a preliminary flat film had been obtained. The flat film showed numerous calcified lymph nodes of the mesentery in the lower part of the abdomen.

There was a large calculus (about 1 by 1.5 cm.) overlying the midportion of the left kidney. A smaller irregular calcification (4 by 6 mm.) was observed in the upper area of the same organ.

The pyelogram showed a normal right kidney and right ureter. On the left there was a bifurcation of the renal pelvis, which otherwise was dilated. The aforementioned calcifications lay in the upper calyx and in the kidney. The ureter appeared normal.

Diagnosis.—The diagnosis was calculi in the left kidney with lesions suggestive of tuberculosis in view of other manifestations and clinical signs.

Treatment.—After preparation with daily doses of 1 Gm. of streptomycin for one week, the patient was brought to operation. General anesthesia was induced; the lower part of the abdomen and the genital area were prepared and draped. The right side was operated

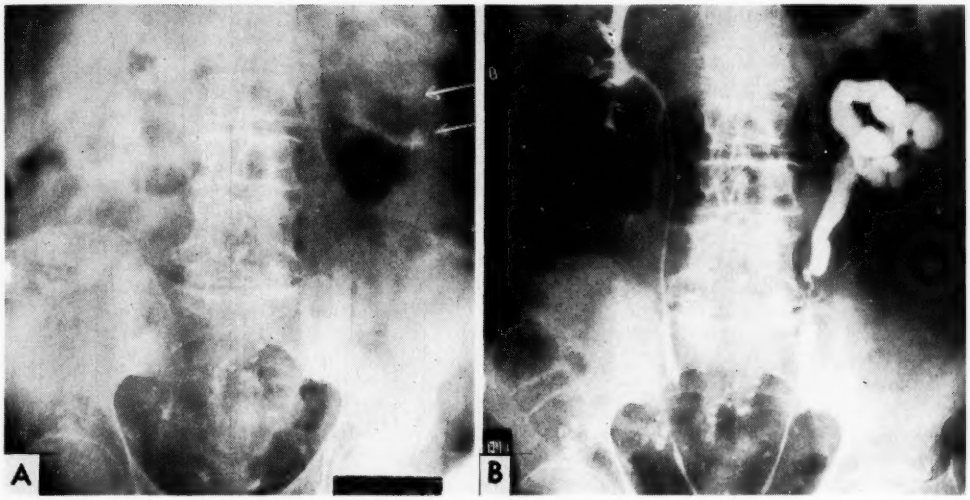

Fig. 1 (see text).

on first. An incision was made from the inguinal region down to the scrotum, circumcising the scrotal skin where the epididymis was attached to the scrotum. The cord was exposed and isolated. The vessels, the cremaster and the vas itself, which, by the way, proved to be normal in appearance, were separated. Each portion was severed and tied. The vas was phenolized. Then the testicle and epididymis, with the cutaneous portion attached, were developed and removed. No pus was encountered.

After the wound was closed, the left side was similarly exposed. Here, however, the ductus deferens was considerably thickened. In developing the testicle, we encountered an abscess in the lowermost portion of the scrotum. We excised until we were in healthy tissue. This involved the sacrifice of a great deal of skin. One Gm. of streptomycin was placed in the wound, which was then closed.

The preoperative medication, 1 Gm. of streptomycin daily, was continued. The patient made an uneventful recovery and was discharged on May 15, with instruction to his home town physician to continue the treatment as in the hospital. He was informed that his left kidney was tuberculous and contained stones. The need for surgical intervention after three months was emphasized.

Pathologic Report.—Gross: The specimen consisted of both testicles, the spermatic cord and the epididymis. There was a small mass of skin on one testicle, measuring 2 cm. in length. The testicle was 6 cm. in diameter, with the surrounding tunica albuginea. On section the tissue was brownish-white. The tubules stripped with difficulty. In the region of the epididymis there was a large abscess 2 cm. in diameter, containing thick caseous material. On section of the spermatic cord, it proved to be moderately dilated, with the plicae flattened. The other testicle showed a similar but more marked picture, with hemorrhage and a sinus tract 4 mm. in diameter. *Microscopic:* A testicular section showed the tubules to be numerous, with spermatogenesis diminished. The interstitial tissue showed a few focal areas of inflammatory reaction, which were most prominent in the epididymis. Here, there were small and large areas of caseous necrosis, with a surrounding layer of granulomatous tissue. An occasional central giant cell was seen, surrounded by epitheloid cells and lymphocytes. Section of the skin showed the sinus tract lined by similar granulomatous inflammatory tissue. Sections of the spermatic cord showed the same type of reaction. *Final Diagnosis:* The final diagnosis was bilateral tuberculosis of the testis, epididymis and spermatic cord.

On October 11 the patient was seen in the office. The scars were solid. He had gained 18 pounds (8.2 Kg.), felt well, and worked

at his regular job. Rectally, the observations were the same as on admission, except that the right seminal vesicle seemed more dense now. The urine was hazy; the *p*H was 4.5. There was no albumin or sugar. Microscopically there were 8 to 15 leukocytes per high power field.

The patient brought with him an intravenous pyelogram taken in his home town. It showed good function bilaterally but revealed dilatation of the left renal pelvis and the aforementioned calculi. A twenty-four specimen of urine, also checked in the patient's home town, was negative for Koch bacilli.

The streptomycin treatment had to be discontinued after three months, on account of tinnitus and partial deafness.

From this moment on, in spite of all warnings, the patient disappeared from our sight until April 1958, when he wrote that he would like to have an appointment "because I am a very sick man."

He stated that since December 1957 retropubic pain had developed with urgency of urination, tenesmus and occasional blood in the urine, which otherwise was very cloudy.

We advised admission, and on May 9 he entered the hospital. His general appearance was pale and sickly. He weighed 214 pounds (96.1 Kg.).

Physical Examination.—The old field of operation was visible as a solid scar. There was tenderness in the left flank, but no masses could be palpated. Rectally there was almost total absence of the prostate gland, and both seminal vesicles appeared as hard strands.

The blood pressure in millimeters of mercury was 170 systolic and 120 diastolic, a notable change from 126 systolic and 80 diastolic when last determined in 1949, but the electrocardiogram was normal. The other physical signs were not remarkable. There was frequency of urination (every twenty to thirty minutes).

Laboratory Data.—Urinalysis revealed a *p*H of 4.5, a positive reaction for albumin and a negative reaction for sugar. Microscopic values of 3 plus for leukocytes and 1 plus for erythrocytes. Tubercle bacilli could be stained from a smear of the microscopic specimen.

Roentgen Examination.—The thoracic film revealed no change since 1949. A flat film of the kidneys, ureters and bladder showed the shadow of the right kidney to be normal and that of the left kidney enlarged. The aforementioned calcifications in the lower part of

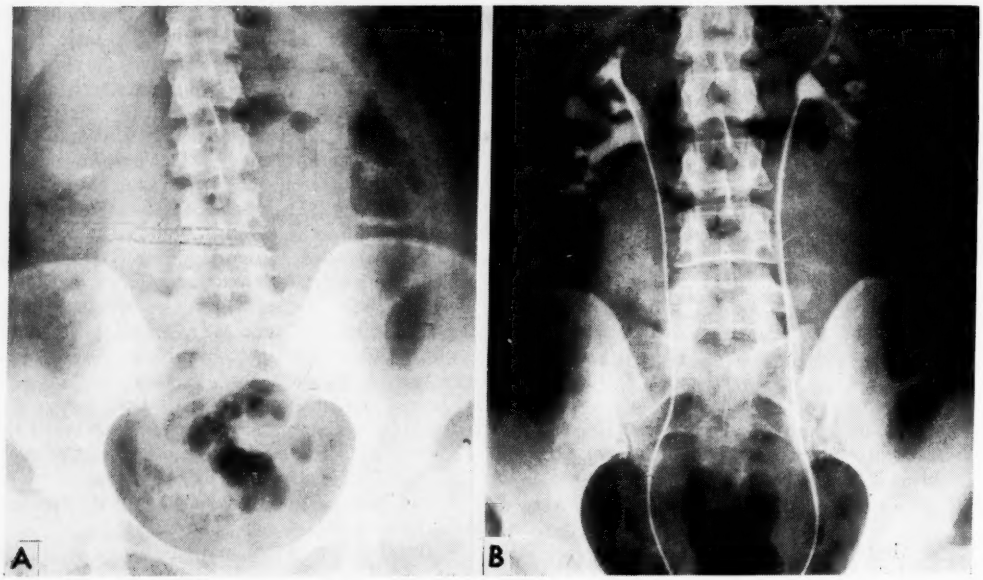

Fig. 2 (see text).

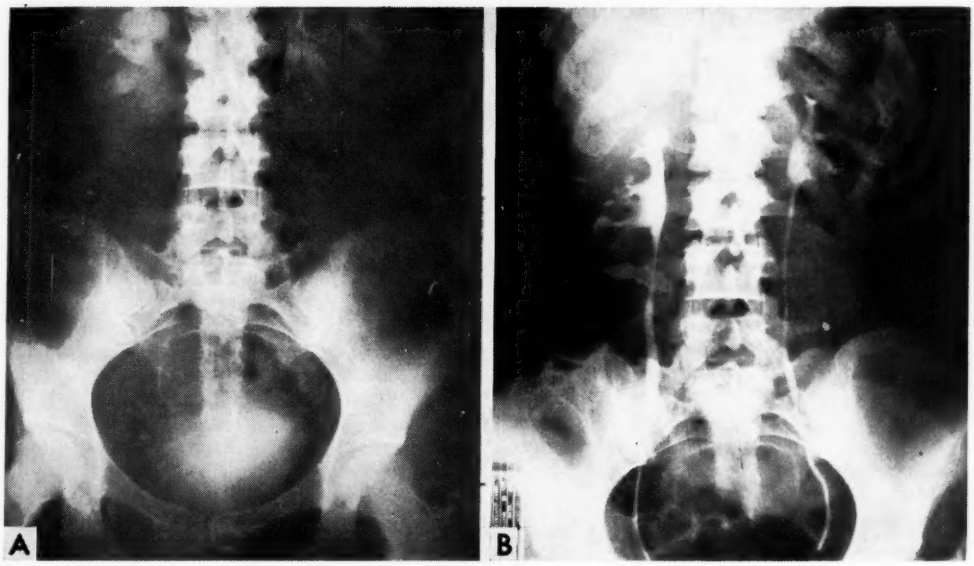

Fig. 3 (see text).

the abdomen were noted, as well as those in the kidney area on the left side (Fig. 1*A*).

An intravenous pyelogram showed the right kidney and ureter to be normal. At no time was sufficient contrast material excreted by the left kidney to show the internal structures.

Cystoscopic Study.—The anterior portion of the urethra was normal. There was widespread scarring in the posterior portion, with the meshlike appearance of the wide-open prostatic ducts previously described.

The appearance of the bladder was suprisingly good on the right side and on the dome. The left orifice, however, was of the golf-hole type and was surrounded by a large area of granulation tissue extending into the left sector of the bladder and the upper sector on the left side. The periphery of this tissue showed elevations strongly suggestive of tuberculosis.

A No. 5 ureteral catheter was easily introduced on the right side. This was done in order to see whether this kidney was still free of infection. The urine from this side was clear, and a later culture proved negative for tubercle bacilli. The left orifice accepted a No. 5 catheter with some hesitation, but it could finally be inserted to a distance of 25 cm. The urine from this side was purulent and contained tubercle bacilli.

Retrograde pyelograms showed the right kidney and ureter to be normal in their inner structures. The left ureter was irregular and constricted below the fifth lumbar level but dilated above it. The inner structures of the left kidney showed a U-shaped blunted cavity with almost no differentiation of the calyces (Fig. 1*B*).

With the diagnosis of tuberculosis verified, treatment was started with daily doses of 1 Gm. of streptomycin, 300 mg. of Nydrazid and 12 Gm. of PAS.

He was brought to operation after ten days of preparation.

A ureteronephrectomy from the insertion into the bladder upward was done. Healing was uneventful, and treatment was continued as preoperatively instituted, except that the dose of streptomycin was reduced to 1 Gm. twice a week, to be continued for one year.

Pathological Report, May 21, 1958.—Gross: The specimen consisted of the left kidney, which was multicystic and had been dissected. It measured 11 by 6 by 4 cm. It was pinkish red, and there were punctate hemorrhagic areas on the surface. Some areas were grayish tan. The section of the kidney was made up almost entirely of cavities, which extended from the cortex to the medul-

lary junction. In the renal pelvis there was a stone measuring 1.5 by 1.5 cm. This was grayish black. The cavities were filled with cheeselike material. The walls of the cavities varied between 1.5 and 1 cm. thick. The largest measured 3.5 by 5 cm. The pelvis itself was whitish gray, with small hemorrhagic areas. The ureter next to the pelvis was 2 cm. wide. The internal folds were gray, granular and nodular. The largest of these nodules measured 1 by 2 mm. The lower end of the ureter was white to gray and moderately firm. The lumen was narrow. There was a granulation mass on the lower end.

Whereas the inner lining of the aforedescribed cavities was for the most part smooth and showed a small amount of granulation, that of one of them had a hard, bony appearance of approximately 2 by 1.5 cm. Between these cavities was yellowish gray fatty tissue.

Microscopic: Sections of the kidney showed a tuberculous process characterized by large areas of caseation. In some areas tubercle formation was observed. The caseating area was surrounded by inflamed granulation tissue with intense lymphocytic and epitheloid infiltration, lymphocytes and Langhans' giant cells.

The diagnosis was tuberculosis of the kidney and ureter and left nephrolithiasis.

Course.—Analysis of the stone showed a core of calcium oxalate surrounded by calcium phosphates and carbonates. Strangely enough, a trace of cystine was present. This may have been due to the presence of adherent connective tissue that was almost inseparable from the calculus.

The patient was discharged on June 1 in good condition, and instructed to continue the treatment as it had been given in the hospital on discharge. His family physician was so advised.

He was next seen on July 3 in the office. The frequency of urination was much reduced. The urine was surprisingly clear. Microscopically there were approximately 20 leukocytes and 4 to 6 erythrocytes per high power field. The blood pressure was 124 systolic and 80 diastolic. The patient had resumed his regular work and promised that he would continue the treatments and let us see him at regular intervals.

CASE 2.—Mrs. C. B., aged 43, was admitted to the hospital on June 26, 1957, with a history of pain in the right flank beginning five weeks prior to admission. The pain was described as dull, sometimes more intense and radiating to the right lower quadrant of the abdomen and to the vagina. A year earlier there had been some pain in the "pelvic organs," and the patient had been told that it was a virus infection. The urine at this time showed erythrocytes and leukocytes. There were no direct urinary symptoms. The early and family history were noncontributory.

Physical Examination.—The patient was in good condition, with good color, and weighed 148 pounds (67.1 Kg.). There was definite tenderness in the right flank and in the midabdominal area. No masses were palpable. The blood pressure in millimeters of mercury was 110 systolic and 80 diastolic.

Vaginal examination gave negative results, as did the remainder of the physical examination.

Laboratory Data. — The electrocardiogram was normal. A complete blood count revealed a hematocrit reading of 38 per cent. The value for hemoglobin was 12 Gm. The sedimentation rate was 48 mm. in one hour. A differential count revealed 62 per cent neutrophils, 3 per cent eosinophils and 36 per cent lymphocytes. Chemical tests of the blood showed the following values: urea nitrogen, 15 mg., cal-

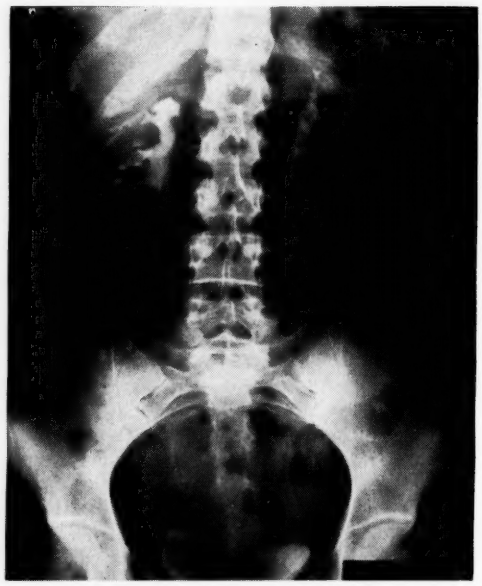

Fig. 4 (see text).

cium and phosphorus, 10 mg. and 4.35 mg. respectively, and sugar 125 mg., per hundred cubic centimeters. The results of serologic tests were negative.

The catheterized urine showed a *p*H of 5. The specific gravity was 1.018. The reaction for albumin was 1 plus and that for sugar was negative. The value for urobilinogen was normal. Bacteriologic study by ordinary culture revealed Aerobacter aerogenes in the bladder urine. Cultures from both kidneys were sterile.*

Roentgen Examination.—A thoracic film revealed no abnormality of the heart and lung fields, other than bilateral calcified lesions in the hilar area. A retrograde pyelogram revealed normal structures of the left kidney and ureter. On the right side there was a calculus in the lower pole, measuring 5 by 10 mm. Distortion and dilatation of the calyx surrounding the stone were present. It was noted that at one spot the dilatation extended close to the cortical surface. The rest of the right kidney and ureter was normal. There was some clubbing of the middle calyx (Fig. 1*A*).

Cystoscopic Data.—The urine obtained cystoscopically was yellow and cloudy. The anterior portion of the urethra was normal; the posterior portion showed a few villi. The bladder showed granular cystitis immediately adjacent to the sphincter area. The ureteral orifices were normal. No. 5 ureteral catheters were easily inserted to a depth of 25 cm. The urine on the left side was clear. On the right side it was cloudy.

Diagnosis.—The diagnosis of calculopyelonephritis in the lower pole of the right kidney was made.

Operation.—At operation on July 5 we observed considerable perinephritis, with dense adhesions. The kidney was isolated, and a rubber-shod intestinal clamp was placed on the pedicle, preparatory to partial resection. A wedge comprising the lower calyx, in which the stone could be palpated, was excised. The kidney pelvis was sutured with No. 000 chromic catgut, and the individual vessels were tied. When hemostasis was satisfactory, a few mattress sutures were placed on the edges of the renal wound and secured by fat pads. An incidental nephropexy concluded the operation. The postoperative course was feverish for about two weeks. It improved satisfactorily as soon as treatment was started with streptomycin, PAS and Nydrazid. (On July 11 tubercle bacilli were observed microscopically.)

Nevertheless, although the wound healed well at first, there was some discomfort in the right flank, and later a sinus developed, from which there appeared a serohemorrhagic drainage. This continued for two weeks, after which time it closed and remained healed. The patient was discharged on July 22 in good condition.

Repeated urinalyses revealed no tubercle bacilli in the smear and culture.

Pathological Report.—Gross: The specimen consisted of a renal pole measuring 4 by 2 by 1.5 cm. The surface was irregular in appearance; the consistency was firm. On section one observed a rugged gray stone. The surrounding calyceal lining was thickened and indurated and had fibrinous appositions.

Microscopic: Sections of the kidney showed interstitial fibrosis with marked round cell infiltration. The tubules were atrophic and the epithelial cells small. In some areas there was granulomatous formation, with multinucleated giant cells. Although no frank necrosis was noted, the diagnosis of tuberculosis was strongly suggested.

The diagnosis was chronic granulomatous inflammation of the kidney, tuberculosis and nephrolithiasis.

Analysis of the stone revealed calcium oxalates and phosphates.

The patient was treated by her family physician with 1 Gm. of streptomycin a week and daily doses of 300 mg. of Nydrazid and 12 Gm. of PAS. The latter had to be omitted after October.

By January 1958 the patient "felt fine" and had gained 6 pounds (2.7 Kg.) over her admission weight. The catheterized urine was clear; the *p*H was 4.5, and no sugar or albumin was present. Microscopically there were very rare red and white blood cells.

In March 1958 severe right unilateral headache developed, and on March 5 there was transient paralysis of the left hand. The patient was readmitted to the hospital. The urine was absolutely normal in every respect. Culture gave negative results for tuberculosis. A neurologic consultation was obtained. The opinion of the consultant was that the patient had a deep-seated, though small, vascular oc-

*It should be noted, however, that the patient had been treated with achromycin prior to admission. A smear for tuberculosis was not done.

clusion caused by Nydrazid. He suggested that we discontinue all antituberculosis medication, particularly since the urine was normal.

An intravenous pyelogram taken at this admission showed the left kidney and ureter to be normal. On the right side there was a slight deformity of the middle calyx. What remained of the lower calyceal system was narrow. This can be considered an altogether normal pyelogram for a kidney after partial resection (Fig. 2*B*).

The patient's condition improved and became entirely normal, so that she could resume her regular work.

COMMENT

In the first case the diagnosis of tuberculosis and stone of the left kidney was obvious. Unfortunately, the patient withdrew from treatment much too long, although this kidney hardly offered a good prospect for conservative operation. It is hoped, however, that he will have suffered no lasting damage. The stone in the kidney was observed for nine years. There were two different calcifications in this kidney: first, the true stone, as proved by the analysis, and second, the shell-like calcification in the upper calyx, probably chalklike solidifications of caseous material. Whether the increase in the blood pressure can be attributed to this kidney (so-called Goldblatt phenomenon) is an open question. Yet it must be noted that the pressure returned to normal postoperatively.

In the second case we missed the diagnosis and obtained it only after pathologic examination of the tissue. The absence of ordinary bacilli was attributed to the previous treatment with achromycin. The only clue that could have directed our thoughts to tuberculosis was the shell-like appearance of the lower calyx in the pyelogram.

It is this problem of diagnosis with which Couvelaire and Brizon were confronted, just as we were in the second case. Let us consider all the factors these authors bring up as helpful in diagnosis:

1. Radiologic differentiation between true stones and calcification of caseous matter. The stones appear more regular, are solid and need not be located in the tuberculous lesion proper.

2. The presence of persistent cystitis, which normally is not connected with renolithiasis.

3. The presence of tuberculosis in other organs, which, however, in these authors' extensive material, was proved in only 2 cases.

4. Constant and repeated search for the Koch bacillus in all cases.

5. The discrepancy between the size of the stone and the cavity in which it is located.

6. The "beaded" ureter, particularly if it is also affected by stricture.

If we apply these factors to our cases, we find that Points 4 and 5 are especially helpful.

In their comprehensive paper, the authors mention forms of lithiasis and tuberculosis that we may encounter here only rarely. All the more, however, should we familiarize ourselves with the problems they encountered in the management of bilateral renal tuberculosis with simultaneous bilateral lithiasis. Some of the patients were admitted with anuria. One interesting aspect is the appearance of stones in the opposite kidney in cases of tuberculosis of the bladder and adnexae (male and female patients). The authors consider this caused by reflux through the impatent orifice and consequently talk about "reflux lithogène."

As to the therapy, this, of course, depends on the degree of destruction, and their advice ranges from partial nephrectomy and speleotomy (when the lesion is in the middle calyx) to total nephrectomy.

In case of contraction of the bladder with either reflux or contraction of the ureter, individualization from ileocystoplasties to ureteroileoplasties and cutane-

ous ureterostomies is advised. The bad results of implantation of tuberculous ureters into the colon, however, make them give the reluctant advice to transplant only ureters that do not drain tuberculous infected urine. This is easier said than done.

The most interesting problem in these cases, however, is the question: What was first, the tuberculosis or the stone? To this Couvelaire and Brizon give no answer except in the cases of reflux lithogène. Are either the stones or the tuberculosis incidental to each other, or is there interdependence? In our search for an answer we found one paper that may throw some light on this question. Gouygou observed, on thorough and methodical histologic examination of kidneys and other organs afflicted with tuberculosis, *microscopic* calcifications which he called "phyllolithes."

The origin seems twofold: 1. They can form in small blood vessels (interlobular) and can completely obstruct them. They show concentric calcifications that appear, on section, leaflike (hence their name). The adventitia and media are infiltrated with round cells; the intima has disappeared. This is definitely the rarer form.

2. The second type is absolutely similar in construction, but it is more common. It is related directly to active tuberculous lesions, and according to the details of this paper, is represented by giant cells in transitional form, from necrosis to retraction, leaving cytoplasmic strands that unite them to the syncytium of epitheloid cells around them. In this, calcium deposits occur in the form of a basophilic layer. At this stage pyknotic calculi may well be observed. Later they disappear and new lamellae of calcium form.

The total incidence of phyllolithes in cases of renal tuberculosis was 20 per cent.

Assuming it as reasonable that such a phyllolith, which evidently is made up of two substances of variously intense basophilic calcium content, can become the nucleus for deposition of any crystalline substance, in our cases predominantly calcium oxalate, then we should have to say that in some cases the renal tuberculosis doubtless precedes stone formation. In others a stone may form first, and the tuberculosis is incidental to the nephrolithiasis.

There is one other etiologic problem to be considered, as is brought out by Vincent and Pelot. These authors have observed that strictures, intrarenal or in the ureter, as they can develop under prolonged medical treatment, may become a factor in the formation of a calculus. The possibilities for their development are even greater when there exists a secondary infection. Both authors report cases of clinical, radiologic and bacteriologic immediate cure. Later, however, strictures became pronounced; stone formation followed, and secondary infection made nephrectomy necessary. In Pelot's case the pathologist discovered formerly unobserved cavitations. This prompted the author to say a word of caution as to what should be the criteria of cure. If a tuberculous kidney treated medically seems radiologically and clinically cured and still can have hidden cavities, then one should search for still more accurate diagnostic procedures. Perhaps arteriographic study would be helpful.

Another point to be considered is this: Before the discovery of specific antituberculosis drugs, patients were treated, according to Charpy, with large doses of Vitamin D and calcium. As is now known, this can cause tubular calcifications. Although this treatment was never used widely in the United States, it may be a factor to be considered in dealing with patients who come from abroad.

Seven to 35 per cent of patients with pulmonary tuberculosis are reported to have renal tuberculosis also. When one considers that these patients were, before

the antibiotic era, bedridden for months and sometimes years, it is astonishing that we were unable to find reports on stone formation. Recumbency and infection should have provided an ideal preconditioning for lithiasis.

As to therapy, there was no possibility of saving the kidney in our first case. Whether this possibility existed nine years earlier we do not know, and we have serious doubts.

In the second case the patient required preservative operative therapy even if we had made the correct diagnosis preoperatively. Of course, we would have subjected this patient to prolonged preoperative chemotherapy. It is clear that the exclusively medical treatment of tuberculosis, in the presence of stones, will never succeed. Removal of the calculus in one form or another, as outlined by Couvelaire and Brizon, is a prerequisite to successful postoperative medical treatment of tuberculosis. Without the discovery of streptomycin, all tuberculous kidneys in such cases would have to be sacrificed.

Even if the number of cases in which conservative operation is indicated and offers hope is still small, as outlined by Lattimer, Nesbit and MacKinney, further improvement of medical as well as surgical therapy will widen the indications.

It is in this light that we wish to report a successful operation as developed and advocated by Puigvert.

Mrs. D. S., aged 27, was admitted to the hospital on April 14, 1952.

Her father had undergone an operation for kidney stone; otherwise her family history was irrelevant.

She had one child and had been well until one and a half years prior to admission. Vague pain then developed in the right flank, lasting for a few days and recurring about every two or three months. In her home town the tentative diagnosis of nonopaque calculus was made. Several cystoscopic procedures were done, with no positive results. Five weeks before she was referred to us, however, she had her first severe attack of right renal colic, with bloody urine. Another one followed forty-eight hours before admission, this time associated with chills, fever, nausea and vomiting. Frequency of urination was present (every two or three hours day and night).

Physical Examination.—On admission the patient was pale but well nourished, with an asthenic body type. She weighed 115 pounds (52.1 Kg.). The temperature was 36.5 C. The blood pressure in millimeters of mercury was 120 systolic and 80 diastolic.

Laboratory Data. — There were 4,000,000 erythrocytes and 11,700 leukocytes per cubic millimeter of blood. A differential count revealed 79 per cent neutrophils, 19 per cent lymphocytes and 2 per cent large monocytes. Chemical tests of the blood revealed normal values. Urinalysis revealed a *p*H of 4.5, a trace of albumin and no sugar. There were many white blood cells and a few epithelial cells per high power field. The electrocardiogram was normal. A roentgenogram of the chest showed enlarged hilar shadows on the left, but was otherwise normal. Bacteriologic study showed gram-positive cocci and no tubercle bacilli.

Upon palpation, one could feel a tender, nonmotile mass in the right upper abdominal quadrant. There were flank tenderness and some ballotement on bimanual examination. The rest of the physical examination revealed no abnormality. Observations at vaginal examination are included in the cystoscopic report.

The clinical diagnosis was infected hydronephrosis, right, with or without calculus.

The patient presented an intravenous pyelogram taken in another hospital two weeks prior to admission, which showed a normal genitourinary tract on the left side. On the right side there was general enlargement of the kidney. The pelvis was moderately enlarged, the calyces blunted. The ureter was enlarged, but the lumen was smoothly outlined. There was an obstruction in the ureterovesical junction, and the emptying time was lengthened considerably (Fig. 3*A*).

Cystoscopic study on April 15 revealed the urine obtained from the bladder to be clear and yellow. The anterior and posterior portions of the urethra were normal. The bladder and the left ureteral orifice were normal. The striking observation in this case was the area around the right ureteral orifice. There

were bulging granulomatous masses which gave it the appearance of a mulberry. The orifice itself was not visible. By simultaneous examination from the vagina, a wormlike mass corresponding to the orifice was palpated. The mass could be moved by the finger and no doubt corresponded to the thickened ureter.

Indigocarmine appeared promptly and in good concentration on the left side. There was no visible expulsion of urine from the right orifice, and no dye appeared during a twenty-minute observation. No ureteral catheter could be passed on the right side.

Since we could have been dealing with a specific or nonspecific granulation tumor as well as with a malignant growth, we decided to take the risk of a biopsy.

Vaginal examination showed a normal cervix. Bimanual examination revealed nothing abnormal except the aforedescribed wormlike structure.

The pathologist's diagnosis of the biopsy was "inflammatory overgrowth from the bladder."

The preoperative diagnosis was granulation tumor on the lower end of the right ureter, possibly caused by a nonopaque stone or specific inflammation (tuberculosis).

In either case we were convinced that removal of the obstructive end of the ureter should be attempted. The absence of cavitation in the kidney and the obstruction in the upper portion of the ureter would make it a good prospect for the so-called Puigvert operation in case tuberculosis could be verified.

On April 18 the ureter was exposed by a right hockey-stick type of incision beginning above the os pubis and running up the right border of the rectus muscle. The ureter was thickened but easily freed where it crossed the iliac vessels. The closer we came to the bladder, the denser were the adhesions. The ureter was freed and resected out of the bladder, with the whole of the granulation tumor. The healthy bladder was closed. About 4 cm. of the ureter was resected. The pathologist opened the specimen, which had an extremely narrow lumen in the orificial area and a thickened wall proximal to it. No stone was seen. A frozen section was reported as "inflammatory tissue."

The uppermost corner of the bladder was then freed and opened. An oblique channel was made by means of a Moynihan clamp, and the ureter was pulled into the bladder. There was fortunately enough of it to leave a good nipple-like protrusion in the bladder. The implanted ureter was secured to the bladder wall with a No. 000 chromic catgut suture through the thickened ureteral wall and bladder. A T-drain was used as a splint; a Penrose drain was placed in the field of operation, and a Foley catheter was used to drain the bladder.

The immediate postoperative course was good. Three days later we received the report from the Department of Pathology:

"*Gross:* The specimen consists of the lower portion of the ureter, about 3.5 cm. in length. It is slightly pinkish gray. The outer surface is smooth, with some areas of hemorrhage. The internal aspect is granular. Upon section there is a small, firm mass on the lower end.

"*Microscopic:* Section shows a large mass of tissue from the ureter, with the mucosa almost completely absent and replaced by a thick layer of inflammatory tissue. Near the surface this tissue consists of granulation with fibroblastic proliferation and considerable infiltration by lymphocytes, large wandering cells and plasma cells. Throughout the wall of the ureter, however, there are large areas showing granulomatous inflammatory reaction, with many miliary granulomas and numerous confluent and conglomerate inflammatory areas, some of which have central caseous necrosis. They show typical giant cells of the Langhans type, with large masses of epitheloid cells, lymphocytes and some pus cells. In some areas masses of inflammatory granulomatous tissue is seen just beneath the surface. In other areas, where some of the intact mucosa is still present, the inflammatory granuloma is undermining and apparently replacing the overlying mucosa. Diagnosis: tuberculous ureteritis."

After we received this diagnosis we immediately removed the T-drain and the Penrose drain from the wound (April 23). Treatment with streptomycin, 1 Gm. daily, and Nidrazid, 250 mg., was started immediately.

There was a small amount of urinary drainage from the wound, which subsided within ten days. The wound healed solidly thereafter. The Foley catheter was removed on the fourteenth day.

Urine taken before medical therapy was started showed, now that the right kidney was

open, positive results from culture for tuberculosis. The patient improved and was discharged on May 11.

Therapy was continued as in the hospital for three months.

Several cultures and guinea pig inoculations gave negative results after May 2.

The patient gained weight gradually, and the urine cleared. In September the catheterized urine was clear, with a *p*H of 7 and no albumin or sugar. The urobilinogen content was normal microscopically. Leukocytes were rare, erythrocytes very rare and few clumps observable.

The tenderness in the right flank disappeared slowly. The renal mass is still palpable, though no longer tender.

An intravenous pyelogram was taken every six months, alternating with check cystoscopic procedures, until 1955, when she moved. The urine remained clear and completely normal after 1954. There was one incident of acute cystitis, which responded easily to sulfa therapy.

At the last cystoscopy, on April 6, 1955, the bladder was entirely normal. There was clean scar tissue where the original orifice on the right side was removed. The neostomy was visible in the uppermost right corner of the bladder. It had a small proximal lip but was otherwise of the golf-hole type. Indigocarmine appeared in four minutes bilaterally, but in slightly reduced concentration on the right side as compared with the left one. No. 5 ureteral catheters were easily inserted bilaterally. The urine from both sides was clear and normal both microscopically and bacteriologically.

The retrograde pyelogram showed a normal kidney and ureter left. On the right there was slight blunting of the calyces. The pelvis and the ureter were normal. There was bilateral normal descensus of the kidney in the upright position, remarkable in view of the original fixation of the right kidney (Fig. 3*B*).

A cystogram was taken, 400 cc. of 2 per cent sodium iodide being employed. There was reflux on the right side. This fact explains the occasional flank pain on urination reported by the patient.

Early in 1958 she telephoned to report that she was pregnant. We advised her to "go through with it." The obstetrician was informed, and she was frequently examined. The pregnancy was entirely uneventful. On Sept. 15, 1958, she was delivered of a healthy girl. Urinalysis after delivery gave entirely normal results. The pyelogram was unchanged (Fig. 4).

COMMENT

Originally (in 1941) Puigvert was convinced that stenosing lesions of the juxtavesical portion of the ureter acted as a barrier against ascending infection of the opposite kidney. He considered it a postoperative lesion and secondary to a residual specific cystitis. Radiologically speaking, he emphasized the sausage type of dilatation of the ureter either with one stenotic area distally located or one higher up, just juxtapyelonically. Originally he tried to dilate the stricture but was not successful, so he came eventually to advise resection and reimplantation of the juxtavesical ureter.

Couvelaire and his collaborators had the same idea as Puigvert. They put more emphasis—and hope—on dilation to create free drainage and give medical therapy a chance. They are aware, however, of the dangers of failure and particularly of secondary infection, which can be induced by dilation. This has caused them to give more consideration to Puigvert's operation.

As to the stenosis in the higher segments and replacement of the ureter with gut, they express the opinion that it is still too early to comment further, but that "one has to weigh the incertitudes and dangers of such an operation against the certainty of a cure by nephrectomy."

In this connection, Obrant has brought out some interesting observations and ideas. In his opinion, early ureteral dilatation may be toxine-induced. It is difficult to decide, however, whether such a condition does not already indicate early mucosal tuberculosis. So far the only sign that a

stricture is tuberculosis-induced, beyond the bacteriologic observations, is the progress of the stricture itself. It is Obrant's opinion that tuberculosis of the surfaces, pelvis, ureter and bladder heals faster and better than do the parenchymatous lesions of the kidney and that, therefore, an attempt at dilation is justified. We know, however, the problematic aspects of this theory, particularly in reference to the pathogenesis of renal tuberculosis.

There is no doubt that free drainage is a prerequisite to success with medical therapy. The sooner this drainage is established, the better. The operation of Puigvert, therefore, seems preferable, particularly since the operative risk is smaller than the danger of losing a kidney by perforation of the ureter or secondary infection, which has been reported as occurring after dilation.

The limitation placed on this operation by Fey in 1952, namely, the presence of normal bladder capacity, seems no longer valid, since we have learned to enlarge the bladder by anastomosis to ileal loops. The other limitation, namely, restriction of the procedure to patients with low ureteral stenosis, will probably have to stand for a while, until we have gathered more experience with healing and a technic of ureteroileoplasty or pelvoileoplasty to replace a tuberculous ureter that contains multiple strictures in the presence of a kidney that seems salvageable with medical treatment. And there is always the possibility of discovery of chemicals and antibiotics more effective than those which are available at present.

In a recent paper, Moonen gave excellent and encouraging examples of the use of ileal loops and temporary cutaneous ureterostomy in surgical treatment of the tuberculous ureter. He has also offered similarly illuminating demonstrations of bladder replacement or enlargement and of Puigvert's operation.

RÉSUMÉ

Deux cas sont décrits, présentant une calculose rénale avec tuberculose concomitante. Dans l'un d'eux le rein a pu être conservé, la guérison ayant été obtenue par intervention chirurgicale conservatrice et thérapeutique médicale. Les problèmes étiologiques soulevés par cette double affection sont discutés.

L'auteur présente encore un cas où l'opération de Puigvert a été pratiquée avec succès. Il fait une analyse de la littérature quant aux indications, aux résultats et aux limites de cette opération.

ZUSAMMENFASSUNG

Es wird ueber zwei Faelle berichtet, bei denen Nierensteine und Nierentuberkulose gleichzeitig vorlagen. Es gelang, eine Niere zu retten und durch konservative chirurgische Massnahmen und medizinische Behandlung eine Heilung zu erzielen.

Aetiologische Fragestellungen hinsichtlich einer Verbindung der gleichzeitig bestehenden Steinerkrankung und Tuberkulose werden eroertert.

Ein Fall wird mitgeteilt, in dem die Puigvertsche Operation mit Erfolg ausgefuehrt wurde. Es wird ein Ueberblick ueber das Schrifttum mit Hinsicht auf die Vorbedingungen, die Aussichten und die Beschraenkungen dieser Operation gegeben.

RIASSUNTO

Vengono riferiti due casi in cui la tubercolosi era associata alla calcolosi del rene Fu possibile salvare un rene e ottenere la guarigione mediante un intervento chirurgico conservativo e la terapia medica. Vengono discussi i problemi relativi alla coesistenza delle due affezioni.

Viene presentato un caso in cui si eseguì con successo l'intervento di Puigvert e rivista la letteratura su questa operazione.

SUMÁRIO

Apresenta dois casos em que coexistem calculos e tuberculose. Conseguio salvar um rim pelo tratamento medicoe terapeutica cirurgica conservadora. Discute os problemas relativos a coexistencia dessas afecções e apresenta um caso em que a operação de Puigvert foi realisada com sucesso. Faz uma revisão da literatura explanando o pre operatorio, indicações e limitações do metodo cirurgico.

RESUMEN

Se presentan dos casos de coexistencia de cálculos y tuberculosis. Es posible salvar un riñón y obtener una curación mediante una intervención quirúrgica conservadora y terapéutica médica.

Se discute tambien el problema etiológico tales como éste de la coexistencia de tuberculosis y litiasis.

Se presenta un caso en el cual se llevó a cabo con éxito la operación de Puigvert. Se revisa la literatura para definir bien las limitaciones y problemas de esta operación.

BIBLIOGRAPHY

Couvelaire, R., and Brizon, J.: Tuberculose Génito Urinaire et Lithiase, Journal d'Urologie, Méd et chir. 62:429, 1956.

Gouygou, M.: Les Phyllolithes Du rein Tuberculeux Histogénèse et Signification, J. d'Urol. 58:263, 1952.

Latimer, J. K.: Partial Nephrectomy for Tuberculosis, A. Rev. Tuberc. 66:744, 1952.

Nesbit, R. M., and MacKinney, C.: Antibiotic Therapy of Urinary Tuberculosis. Interval Report of Six Year Experience, J. Urol. 72:296, 1954.

Puigvert, M. A.: Uretérectomie Avec Ureterocysto-anastomose dans les Sténoses Uretérales Inférieures Tuberculeuses, J. d'Urol. 57:532, 1951.

Couvelaire, R.; Magder, E.; Debray, J. R., and Cros, A.: Decam. Documents: Sur Les Sténoses de L'urétère du tuberculeux, Incidences Radiologiques et Thérapeutiques, J. d'Urol. 58:612, 1952.

Couvelaire, R.: Sur les Cysto-entéroplasties pour "Petite Vessie" Tuberculeuse, J. d'Urol. 57:530, 1951.

Fey, B.; Gouygou, C., and Quénu, L.: L'Opération de Puigvert dans les Uretérites Inférieures au Cours de la Tuberculose Urogénitale, J. d'Urol. 58:492, 1952.

Obrant, K. O.: Ureterveränderungen bei Urogenital Tuberkulose, Ztschr. f. Urol. 48:148, 1955.

Moonen, W. A.: Stricture of the Ureter and Contracture of the Bladder and Bladder Neck Due to Tuberculosis: Their Diagnosis and Treatment, J. Urol. 84:218, 1958.

Vincent, M. A.: Tuberculose urinaire et lithiase de la voie excretrice, J. d'Urol. 64:96, 1958.

Pelot, G.: Tuberculose urinaire et lithiase, J. d'Urol. 64:249, 1958.

It has been my experience through the years and increasingly so that to instil optimism and a cheerful outlook on physical ills is very helpful both in treatment and in prognosis. The raising of the morale has a favorable physiological effect in itself and, I am certain, tends to counteract some of the harmfulness resulting from the so-called alarm reaction. A cheerful outlook is often fully justified if added to the medical or surgical measures that are being carried out, and it may be the one additional factor that turns the tide and wins the battle.

—*White*

Arborization of the Cervical Mucus: Its Assessment by the Fern Test

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Arborization of phlegm and other substances is a chemical process of crystallization. It occurs in the mucus of the uterine cervix merely while the cervix is being conditioned by estrogen. The presence or absence of arborization as shown by the fern test therefore permits conclusions with regard to hormone levels and the condition of the cervix (Zondek's "dysmucorrhea").

The fern test has been applied in a large series of clinical cases. It contributed to the understanding of these cases in the following instances:

1. In cases of menstruating sterility, the occurrence and time of ovulation was investigated.

2. In cases of amenorrhea, the hormonal background was studied.

3. In cases of uterine fibroids and ovarian cysts (including persistent follicle) intrauterine and extrauterine pregnancy could be ruled out.

The observations and conclusions are analyzed. They signify that the uterine cervix is an organ of high functional importance.

THE mucus of the uterine cervix, when spread over a slide and seen under the microscope, will present itself in one of the two structures depicted in Figs. 1 and 2. Either it will be amorphous, intermingled with epithelial cells of the cervix and leukocytes (Fig. 1), or it will have crystallized into the picturesque form named "fern" or "palm leaf (PL)" pattern (Fig. 2). The latter process is called *"arborization."*

The absence or presence of arborization permits immediate conclusions of scientific and clinical value. The test to show absence or presence of arborization is called the *"fern test"*; it is easy to perform at the office. Mucus is drawn from the cervical canal with a suction pipette or a heated platinum loop; spread thinly on a slide without stain, it dries and within a few minutes becomes ready for microscopic inspection.

This phenomenon and the procedure were first described in 1946 by Papanicolaou. Other American, French and Scandinavian investigators, and during the past few years especially B. Zondek, have thrown much light on their significance.

The process of arborization represents a form of crystallization. Identical formations can be produced by the same treatment by using protein (even amino acids) or carbohydrate solutions as long as certain electrolytes are present. The electro-

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lytes (sodium or potassium salts) are indispensable. The fern pattern can constantly be demonstrated on the contents of ovarian cysts and on any kind of body mucus, e.g., nasal secretion.

In the cervical mucus, however, arborization is not always present. It is predominant during the seventh to seventeenth days of an average cycle of twenty-eight days or, better, during the estrogen-dominated part of the cycle (Fig. 3). The estrogen causes the healthy cervix to produce the electrolytes which are indispensable to chemical completion of the arborization process. Arborization, therefore, is absent during the postmenstrual days, owing to the lack of estrogen (*B1*, Fig. 3) ; it is absent again during the postovulation (premenstrual) days, because progesterone inhibits the estrogen (*B2*, Fig. 3). The nonarborizing mucus (Fig. 1) is inimical to the survival of sperm.

Knowledge of the dependence of arborization on hormones enables the investigator to use the fern test in biologic tests of hormones.

Estrogen can be traced and titrated by the appearance of arborization after injection into a female subject without ovarian function. This procedure is simpler than the Allen-Doisy test on castrated rats and certainly less involved than endometrial biopsy. Moreover, it seems to be more sensitive.

Progesterone can be measured by its prevention of the estrogenic arborization effect. It requires fifteen times the amount of progesterone to inhibit the effect of 1 mg. of estrogenic substance.

Androgen is known to oppose estrogen in some instances (e.g., masculinization vs. femininization) and parallel estrogen in others (e.g., effect on bone metastases of mammary carcinoma). In the case of arborization, androgen works parallel to estrogen but is much weaker; up to one thousand times the amount is needed, because merely a small fraction of androgen seems to be converted into estrogenic substance.

Practicing clinicians have found the fern test helpful in diagnosis and in the planning of treatment of ovarian disorders. Following their reports I have applied the test in a large series of patients. The method has aided greatly in the analysis and the handling of the following problems.

The Question of Ovulation in Cases of Menstruating Sterility.—Just as the male partner of a sterile couple is first subjected to sperm tests before any major therapeutic procedure is applied to him, so the sterile woman should not be exposed to any surgical attack before it is determined whether or not she ovulates. The woman who bleeds every four weeks does not necessarily ovulate.

Whether she does can be shown by different tests. Endometrial biopsy during the premenstrual period permits differentiation between ovulatory and anovulatory cycles; however, it involves minor surgical measures. The basal temperature charting is a less traumatic method, but it presupposes two months of reliable, intelligent cooperation by the patient herself.

The fern test eliminates these two hazards. Arborization during the second week of the cycle, followed by the absence of arborization during the fourth week, indicates that the early estrogenic arborization effect (+, Fig. 4) has become inhibited by the progesterone action of the corpus luteum resulting from ovulation (—, Fig. 4). This pattern proves ovulation (Fig. 4*A*).

It is obvious that a late negative test result alone cannot be conclusive evidence of inhibition, since one must demonstrate first, by the earlier positive test result, that there was something to inhibit.

A negative result from a fern test made

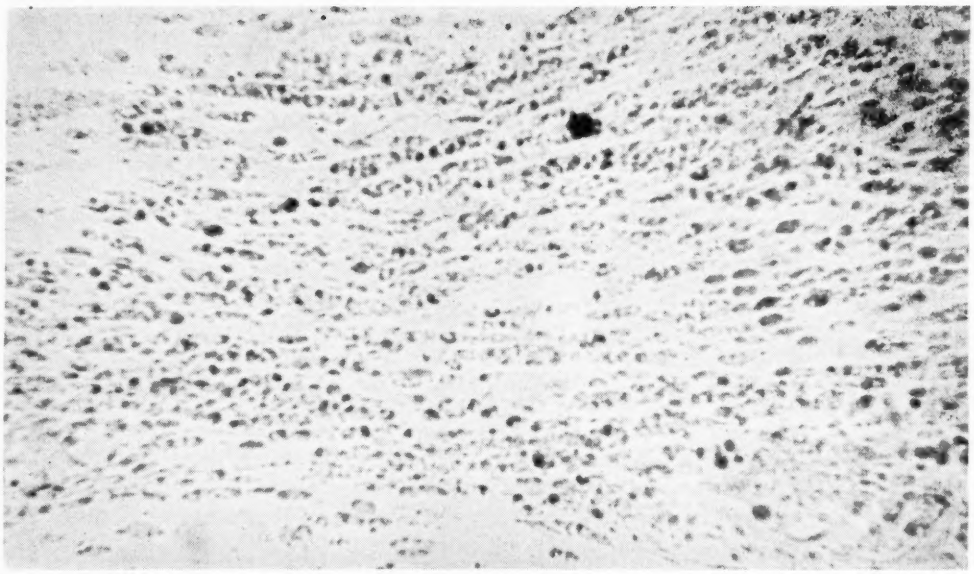

Fig. 1.—Cervical mucus; amorphous form, intermingled with epithelial cells of the cervix and leukocytes.

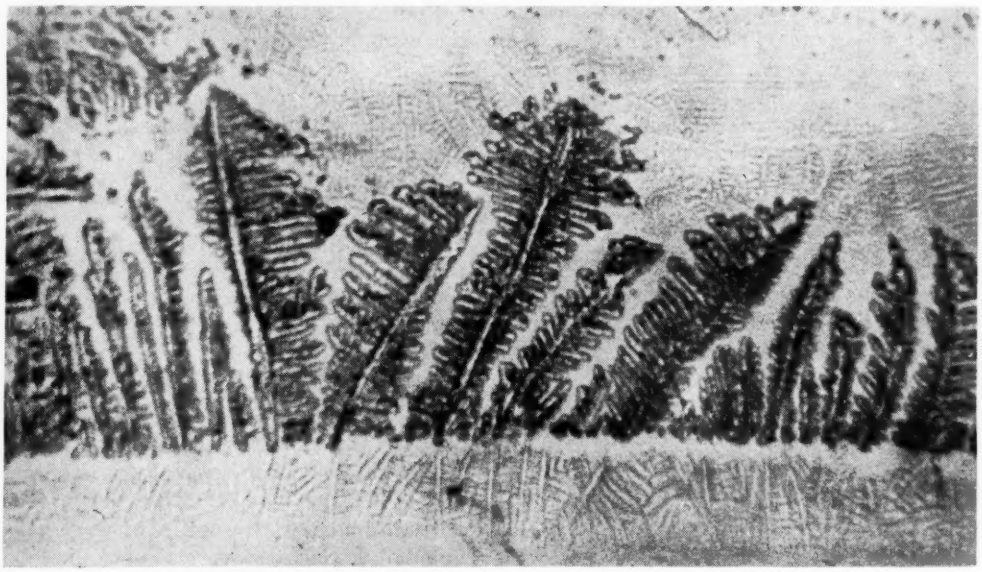

Fig. 2.—Cervical mucus crystallized into "fern" or "palm leaf" pattern (arborization).

early, during the second week of the cycle (Fig. 4*B*), would indicate that no estrogenic substance was ever formed or that it was formed but incapable of inducing a *diseased cervix* to produce the electrolytes needed for arborization. To the latter

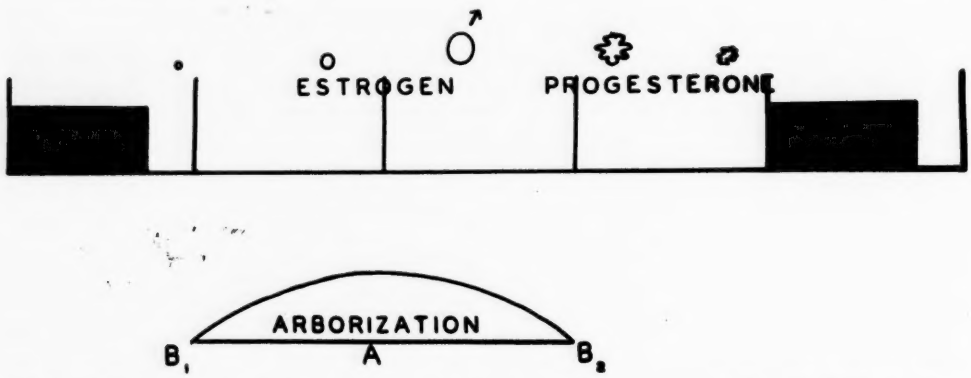

Fig. 3.—Schema showing predominance of arborization during estrogen-dominated part of cycle.

entity B. Zondek has given the name of "*dysmucorrhea.*" Dysmucorrheic patients need cervical treatment, not hormones.

If the two fern tests during the cycle both yield positive results (Fig. 4*C*), it becomes apparent that not enough progesterone was produced to inhibit arborization premenstrually. No progesterone means no corpus luteum formation; no corpus luteum formation signifies absence of ovulation. The patient almost surely has had an anovulatory cycle. Women who do not ovulate need to be treated differently from women who do ovulate but do not conceive.

Determining the time *when* a woman ovulates may permit useful marital advice or corrective hormone therapy in case of disturbance. The fern test gives merely an approximate answer as to the day of ovulation. Ovulation must have occurred several days before the corpus luteum has turned the result of the fern test negative. Biologic variations do not permit a more definite timing.

Study of the Hormonal Background in Cases of Amenorrhea.—Failure of the female organs to produce menses can have various causes. The fern test contributes to their differentiation.

If an amenorrheic woman consistently presents a negative reaction to the fern tests, the absence of arborization proves the absence of estrogen (Fig. 5*A*). Her case has to be followed up in the light of the missing estrogenic hormone and the consequent absence of endometrial proliferation.

Rudimentary arborization is observed occasionally in amenorrheic patients. This may indicate an inadequate supply of estrogen: enough for the sensitive cervix to produce electrolytes and therefore the trace of a fern pattern, but insufficient for the less sensitive uterus to build up the proliferative endometrium.

Normal fern test patterns—positive before and negative after ovulation (Fig. 4*A*)—in amenorrheic women indicate normal production of ovarian hormones; in these cases the amenorrhea is the result of local endometrial disease (e.g., endometritis or tuberculosis).

If the results of fern tests in an amenorrheic woman consistently turn out positive, then the marked arborization indicates an excessive supply of estrogenic substance. Cases of persistent follicle belong here, in which an unruptured graafian follicle keeps on producing estrogen while the progesterone-directed secretory phase of the cycle never occurs (Fig. 5*B*). Obviously in these cases of amenorrhea the

patient needs different treatment from that required by a patient with the type of amenorrhea presented in Figure 5*A*.

Exclusive of the Diagnosis of Pregnancy.—Under the study inhibitory influence of the corpus luteum of pregnancy the cervical mucus of a pregnant woman cannot show arborization (Fig. 6). This obvious and logical fact was responsible for the occasional announcement that the negative fern test result could be used for the early diagnosis of pregnancy. So much was never claimed by the originators of the test, who recognized the fact that pregnancy is merely one of several conditions associated with constantly negative results from the fern test. The menopause or the type of amenorrhea demonstrated in Figure 5*A* will also show continuous absence of arborization.

The latter two conditions are fern-negative because of the absence of estrogen. Injection of estrogen turns the reaction fern-positive within a few days. This does not work in pregnancy: estrogen injec-

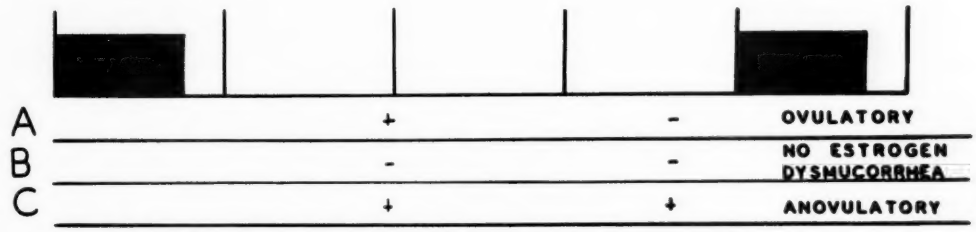

Fig. 4.—Schema illustrating application of fern test to differentiation between ovulatory and non-ovulatory cycles.

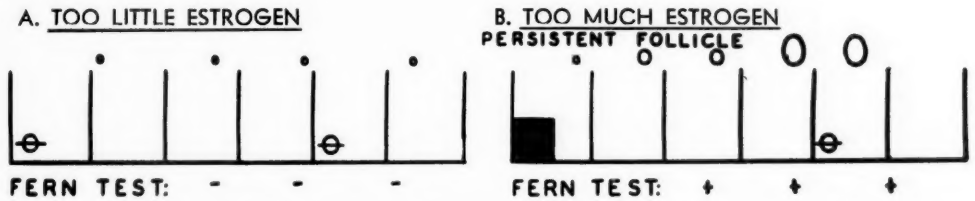

Fig. 5.—Schema of two types of amenorrhea caused by different kinds of hormone imbalance. *A*, results of fern test when there is too little estrogen; *B*, results when there is too much estrogen.

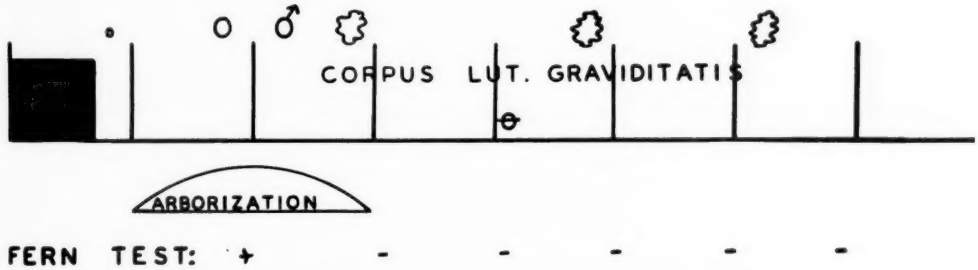

Fig. 6.—Schema showing inhibitory effect of corpus luteum of pregnancy on arborization.

tions do not result in the fern pattern, since the cervix of the pregnant uterus is incapable of producing the electrolytes needed for arborization. The ready conclusion that progesterone of the corpus luteum of pregnancy bars electrolyte production has been proved incorrect; electrolytes, and consequently the fern pattern, are not formed either late in pregnancy or in cases of missed abortion, when no progesterone circulates. It appears that the inhibiting effect upon the cervix is produced by placental secretion.

The role of the placenta is shown by further observations. Zondek obtained slightly positive results from the fern test in some exceptional cases of pregnancy; all these cases ended in miscarriage. Zondek concluded that in such cases some placental disturbance results in failure to affect the cervical electrolyte chemical picture and in failure to maintain the pregnancy. It is therefore permissible to deduct from a slightly positive fern reaction during pregnancy the suspicion that this pregnancy may be disturbed.

Real, solid arborization of the cervical mucus has never been reported as observed during pregnancy. A clearly positive fern test result, therefore, rules out pregnancy. It is here that the fern test gains diagnostic importance: in the differentiation between pregnancy and fibroid of the uterus, arborization *rules out pregnancy* and tips the scale toward fibroid. In the differential diagnosis between tubal (unruptured and unaborting) pregnancy and ovarian cyst or persistent follicle, arborization rules out pregnancy. In conjunction with the remainder of the diagnostic armamentarium, the fern test here has significant practical value.

The simplicity and conclusiveness of the fern test will cause more and more scientific-minded practitioners to study arborization for the analysis of many of their gynecologic problems.

A predictable relation between cervical mucus and general pelvic and endocrine physiologic and pathologic states will impress the observer with the probability that the uterine cervix may have more functions than just to open and close the uterus.

Much active topical therapy has been given to the cervix, which is readily accessible and is not sensitive to pain from cutting and burning. Growing understanding of the functional significance of the cervix will result in a refined therapeutic approach to this organ.

ZUSAMMENFASSUNG

Die baumartige Verzweigung von Schleim und anderen Stoffen ist ein chemischer Prozess der Kristallisierung. Er tritt beim Schleim des Gebärmutterhalses auf, wenn dieser unter dem Einfluss des östrogenen Hormons steht. Das Bestehen oder Fehlen der baumartigen Verzweigung gestattet daher Schlüsse auf den Hormonspiegel und auf den Zustand des Gebärmutterhalses (Zondeks Dysmucorrhoe).

Die Farnprobe ist in einer grossen Reihe von klinischen Fällen angewandt worden und hat in folgender Weise zum Verständnis dieser Fälle beigetragen:

1. In Fällen von Sterilität bei erhaltener Menstruation wurde das Auftreten und die Zeit der Ovulation erforscht.

2. In Fällen von Amenorrhoe wurde der hormonale Hintergrund untersucht.

3. In Fällen von Gebärmuttermyomen und Ovarialzysten (einschliesslich persistierenden Follikels) konnte eine intrauterine, oder extrauterine Schwangerschaft ausgeschlossen werden.

Die Untersuchung der Befunde und der Schlussfolgerungen ergibt, dass der Gebärmutterhals ein Organ von grosser funktioneller Bedeutung ist.

RÉSUMÉ

L'arborisation du flegme ainsi que d'autres substances est un processus chimique de cristallisation. Elle se forme dans le mucus du col de l'utérus alors que le col est conditionné par l'oestrogène. La présence ou l'absence d'arborisation telle qu'elle est démontrée par le test de la fougère, permet donc des conclusions quant aux niveaux hormonaux et à l'état du col (dysmucorrhée de Zondek).

Le test de la fougère a été appliqué à une importante série de cas cliniques. Il a contribué à une meilleure compréhension des cas suivants:

1. Stérilité menstruelle: l'occurrence et le temps d'ovulation ont été recherchés.

2. Aménorrhée: l'état hormonal a été étudié.

3. Utérus fibroïde et kystes ovariens (y compris les follicules persistants) : la possibilité d'une grossesse intra-utérine ou extra-utérine a pu être écartée.

Les constatations, et les conclusions sont analysées. Elles permettent de conclure que le col de l'utérus est un organe he haute importance fonctionnelle.

RESUMEN

La arborización de las sustancias mucosas y otras afines es un proceso químico de cristalización. Suele ocurrir en el moco del cervix uterino, bajo la influencia de los estrógenos. La presencia a ausencia de arborización tal como muestra el test del helecho permite sacar conclusiones en relación con los niveles hormonales y el estado del cervix (dismucorréa de Zondek).

Este test se ha aplicado en una amplia serie de casos clínicos. Contribyó a la mejor comprensión de tales casos en las siguientes circunstancias:

1. En casos de esterilidad con menstruación determina la presencia y tiempo de la ovulación.

2. En casos de amenorrea indica el fondo hormonal.

3. En casos de fibroma uterino y de quistes de ovario (incluyendo folículo persistente) puede determinarse la existencia de embarazo.

Se analizan estos hallazgos y conclusiones. De estos estudios se deduce que el cérvix uterino es un órgano de gran importancia funcional.

RIASSUNTO

L'arborizzazione, che e' un processo chimico di cristallizzazione, si verifica nel muco della cervice uterina quando essa e' sottoposta all'azione degli estrogeni. La presenza o l'assenza di arborizzazione, pertanto, consente di trarre delle conclusioni riguardo al livello ormonale e allo stato della cervice (dismucorrea di Zondek).

Il test e' stato applicato in una numerosa serie di casi clinici e si e' dimostrato utile alla diagnosi nei seguenti casi:

1) Nei casi di sterilita' con mestruazioni consente di studiare l'avvento e il tempo dell'ovulazione.

2) Nei casi di amenorrea, lo sfondo ormonale.

3) Nei casi di fibrosi uterinale e di cisti ovarica (compresa la persistenza del follicolo) si puo' escludere la gravidanza intrauterina o diagnosticarla.

Tutti questi fatti dimostrano la grande importanza funzionale della cervice uterina.

BIBLIOGRAPHY

Classic and Comprehensive Papers

Papanicoloau, G. N.: Am. J. Obst. & Gynec. 51:316-320, 1946.

Zondek, B.: Recent Progress in Hormone Research, New York Acad. Press, 1954.

Zondek, B.: Internat. J. Fertil., 1954.

Detail Studies

Bergman, P.: Acta Obst. & Gynec. Scandinav. 29:4, 1950.

Campos da Paz, A., and da Costa, L.: Fertil & Steril. 4:137-148, 1954.

Roland, M.: Am. J. Obst. & Gynec. 63:81-89, 1952.

Sprague, L. D.: Obst. & Gynec. 4:114-121, 1954.

Urdan, B. E., and Kurzon, A. M.: Obst. & Gynec. 5:3-12, 1955.

Zondek, B., and Rozin, S.: Obst. & Gynec. 3:463-470, 1954.

Zondek, B., and Cooper, K. L.: Obst. & Gynec. 4:484-491, 1954.

Zondek, B.: Forman, J., and Cooper, K. L.: Fertil. & Steril. 6:523-533, 1955.

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Fistulizing Operations for Glaucoma: Their Complications

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PHILADELPHIA, PENNSYLVANIA

THE reasons for failure of fistulizing operative procedures for glaucoma are many. Foremost, of course, is the improper choice of operation. The others are the complications that may occur in the performance of a properly selected procedure, interfering with its outcome.

When a fistulizing procedure is required, the one commonly employed is either the Elliott trephine or iridencleisis. Iridectomy with LaGrange sclerectomy has been employed to a lesser extent. Recently Scheie has introduced a fistulizing operation in which the effect is produced by causing the lips of the scleral incision, made as for a peripheral iridectomy, to retract, by application of the cautery superficially to the wound edges.

These procedures are usually employed in cases of chronic narrow-angle or wide-angle glaucoma and acute attacks of neglected glaucoma, and rarely in cases of aphakic or secondary glaucoma.

The ophthalmologist frequently has difficulty in deciding which of these procedures to use. There is no question that some surgeons are better prepared by experience or training to do one type of procedure with greater facility and dexterity than another. A study of the incidence and type of complications may provide another possible reason for selecting one type of surgical procedure over another.

Complications.—The complications encountered may be divided into those which occur early and those which occur late. The early ones include hyphema, the shallow or flat anterior chamber; vitreous hemorrhage; uveitis; cataract; retraction of the iris pillar when in iridencleisis, and malignant glaucoma. The late complications include uncontrolled tension; progressive visual field loss; cataract; hypotony; upward displacement of pupil;

Various complications, including hyphema, flatness or shallowness of the anterior chamber, malignancy, intraocular infection, cataract, uveitis and uncontrolled pressure, may occur when a fistulizing operation is performed for glaucoma. The author analyzes these complications and their possible causes and reviews his own and other ophthalmic surgeons' experience in the hope that a thorough study of the problem will reduce their incidence significantly.

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corneal edema; uveitis, and intraocular infection.

Hemorrhage. — Theoretically, hemorrhage may be the cause of failure in these operations for glaucoma. It may favor the development of peripheral anterior and posterior synechiae and cause interference with drainage through the angle. Hemorrhage that occurs at the time of operation can be lessened or eliminated by making the incision with the knife at right angles to the sclera, by the use of the scratch-down incision, by the proper use of pressure by local administration of epinephrine to patients who can tolerate it, and by use of the cautery. There are those who object to the last-mentioned measure, stating that the cautery facilitates the development of fibrosis. It is wise to wait until all wound bleeding has ceased, spontaneously or as a result of these measures, before proceeding with the operation—certainly before entering the anterior chamber. It is not always possible to prevent postoperative bleeding into the eye chambers.

Guyton observed hemorrhage, immediate or delayed, in 29 of the 95 eyes operated on, i.e., 30 per cent. In 78 per cent of those eyes which had hyphemas the tension remains controlled, and 92 per cent of those eyes which did not have hyphema were controlled. These figures suggest that hyphema is detrimental and may cause increased scarring along the fistulous tract and in the conjunctival bed. Scheie encountered hyphema in 8 eyes, or a little over 11 per cent, but expressed the opinion that it did not interfere with the final outcome in any instance.

There are, as yet, no proved methods of speeding up the absorption of the hyphemas. Recent studies by workers at Wills Hospital suggest some favorable influence of intravenously administered plasmin. This requires further investigation before its widespread adoption. Earlier enthusiastic reports for the beneficial effects of trypsin, intramuscularly and buccally administered, have not been confirmed. The series have been too small and the difficulties of clinical control not always overcome. Streptokinase and streptodornase have not been granted widespread clinical adoption for this purpose.

Fortunately most of these intraocular hemorrhages are absorbed spontaneously and rarely require evacuation.

Re-formation of the Anterior Chamber. —The slow re-formation of the anterior chamber is the characteristic feature of most filtering fistulizing procedures for glaucoma. To some extent this can be lessened by meticulous tight closure of the conjunctival wound, with the wound edges crushed together and, if a wound leak is present, perhaps cautery to this site can be helpful. Even with careful attention to wound closure, however, flat anterior chambers are frequent and apparently cannot be prevented by any of the current procedures. If no wound leak can be demonstrated, there is usually no urgency in treating a flat anterior chamber. If, however, iritis is evident and there is no filtering bleb and posterior synechiae are beginning to form, it would seem advisable to trephine in the region of the greater separation of the choroid and fill the anterior chamber with air by the method outlined by Chandler. In Scheie's series of 70 eyes the anterior chamber was formed in three days in 45, in seven days in 18, in ten days in 5 and in two weeks or longer in 2. Only 1 did he treat by injection of air into the anterior chamber. In Guyton's series, when iridencleisis had been performed, shallow or flat anterior chambers were noted in 25 eyes. Tension was controlled in 21 of 23 eyes, or 91 per cent, in which the chamber was shallow or absent, and in 54 of 63 eyes, or 86 per cent, in which the anterior chamber remained adequately formed after the operation. In Guyton's series it would seem that shallow or anterior chambers had

little or no effect on the eventual result obtained, In Scheie's series the long delay in the formation of the anterior chamber did not appear to influence the eventual control. Stallard, using his anterior flap sclerotomy with basal iridencleisis, had an incidence of choroidal detachments of about 10 per cent in cases of chronic simple glaucoma and 19 per cent in cases of chronic narrow angle glaucoma, and he considered this the most common complication of this operation. It occurred in about 11 per cent of all patients he operated. He also expressed the opinion that if the chamber were absent for four days or remained very shallow, without increase of depth, for seven days after operation, drainage of subchoroidal fluid and inflation of the anterior chamber with sterile air would be proper, in order to prevent peripheral anterior synechiae and lens opacities.

Cataract Formation. — After glaucoma operations, opacities in the lens may be expected to develop sooner than if no operation had been performed. This tendency increases with the patient's age. This means that one must be particularly aware of this possibility if a patient already has lens opacities, for the surgeon must realize that eventually cataract extraction will have to be done, and therefore should select a procedure or approach for treatment of the glaucoma that will allow a satisfactory lens extraction to be done at a future date.

Cataractous changes that develop a few days after operation are probably due to the surgeon's having inadvertently touched the lens capsule. Certainly this must be true if a mature cataract develops a few days after operation. There is indication that there has been some direct injury to the lens capsule with a surgical instrument. Sometimes this is observed in iridectomy. The site of injury may be visible, or it may be covered and masked by the iris. There is a greater possibility of damaging the lens in a blue-eyed than in a brown-eyed iris, the blue-eyed iris being thinner and affording less protection to the lens. This is true also of the old, senile, fragile iris. Those lens opacities which develop within a few weeks after operation may also be due to an instrument's having struck the lens at the time of operation. Those that develop months or years after operative trauma may still be playing a part, but it is more likely that the altered physiologic character of the eye is the main factor. There is no doubt that postoperative hypotony predisposes to the early development of lens changes. It is this danger of striking the lens that has made many ophthalmologic surgeons switch from the trephine procedure to iridencleisis and, more recently, to the diathermy scleral shrinking technic of Scheie. Procedures that do not necessitate placing an instrument within the confines of the eye have a decided advantage in

TABLE 1.—*Complications of Fistulizing Procedures for Glaucoma*

1. Hyphema	4. Intraocular infections
2. Flat anterior chamber	5. Cataract
3. Malignant glaucoma	6. Uncontrolled pressure

7. Uveitis and others . . .

TABLE 2.—*Summary of Recent Series of Fistulizing Procedures for Glaucoma*

	Iridencleisis	*Anterior Sclerectomy and Basal Iridencleisis*		*Peripheral Iridectomy and Sclerotomy by Diathermy*	
	Haistern & Guyton 1959	*Stallard 1958*	*Mulberger & McDonald 1956*	*Scheie 1959*	*Leopold 1959*
No. of Eyes	95	311	62	70	90
% controlled with (or without) miotics	84%	96%	94%	88%	83%

TABLE 3.—*Operations for Glaucoma: Iridectomy with Cautery to Scleral Wound*

Type of Glaucoma	*No. of Eyes*	*Controlled*			*Re-formation of Anterior Chamber*			*Complications*	
		Without Miotics	*With Miotics*	*With Hypotony*	*Uncontrolled*	*< 7 Days*	*7 Days +*		
Narrow Angle									
Acute	12	10	—	1	1	6	6	Uveitis Hyphema	2 1
Chronic	16	10	2	1	3	7	9	Uveitis Hyphema	1 2
Chronic Simple									
Angle open	21	11	2	2	6	8	13	Uveitis Hyphema Cataract, Advanced	3 2 1
Angle narrow	36	24	4	3	5	10	26	Uveitis Hyphema Cataract, Advanced	3 3 1
Secondary									
Essential iris atrophy	3	2	—	1	—	1	2	—	
Aniridia	2	2	—	—	—	2	—	—	
TOTAL	90	59	8	8	15	34	56		

this regard. In an effort to avoid this type of lens damage, Chandler has suggested deepening of the angle of eyes with narrow angles prior to doing trephine operations, by injecting saline solution through a slanting corneal incision until the chamber is made deep. The use of a tapering trephine blade would also decrease this possibility. For years it has been stressed that iris forceps should not have posterior teeth or, preferably, should have all teeth removed. One should avoid passing an iris repositor into the anterior chamber, and of course there is always the danger that the keratome point or the knife may strike the lens unexpectedly, particularly as a result of movement on the part of the patient.

Postoperative Elevation of Intraocular Tension.—Within six weeks one usually can determine whether or not intraocular pressure has been satisfactorily controlled by the surgical procedure. There may be no evidence of a bleb or there may be a bleb, but the pressure is not adequate. Analysis of the scleral rigidity will show whether or not this is a contributing factor; usually it is not. It is quite possible, as Sugar has suggested, that this failure of control in the presence of a bleb is due to hypersecretion, but more probably it represents fibrosis within the bleb, which prevents adequate filtration. It is generally accepted that iridencleisis and the other procedures lower the intraocular pressure by creating a fistula through which aqueous can drain to the subconjunctival bleb. Fluid is absorbed from here or may pass transconjunctivally to mix with the tears. Rarely does the tension remain elevated in the presence of an apparently functioning bleb. In such instances, however, the bleb has a thick covering of fibrous tissue that limits its effectiveness. In an occasional case, Guyton has pointed out, the tension is normalized even after iriden-

cleisis when there has been no clinical evidence of filtration. Reese has stated that iridencleisis may control the intraocular pressure in three ways: (1) by creating a filtering sluiceway; (2) by iridodialysis, in that the angle is freed over the area of the coloboma, and (3) by traction on the iris pillars, which tends to stretch and tighten the iris and prevent it from blocking the angle inferiorly. The latter two theories may explain why the tension is occasionally controlled after iridencleisis when there is no evidence of external filtration. Many suggestions have been made in an effort to reduce this degree of bleb fibrosis without allowing too thin a bleb to develop. Two possible causes of conjunctival scarring that may account for a certain number of thick flaps may be mentioned here. First, cotton fibers left under the conjunctional flap produce irritation and consequent fibrosis as was pointed out by Richardson in 1956. Second, a leaking bleb may result in collapse of the bleb and final scarring of the whole area. This is probably an extremely rare occurrence and can usually be diagnosed by failure of re-formation of the anterior chamber, possibly with a staining area over the bleb during the first few days after the operation. Stanworth expressed the opinion that congestion of the eye prior to operation predisposes to the development of fibrosis, particularly if the filtering procedures have to be used in eyes with uveitis. Granting that hemorrhage may also predispose to fibrotic changes, he does not advocate use of the cautery, lest it result in dead tissue and consequent areas of fibrosis.

There is no doubt that there is something constitutional in the problem; some persons are predisposed to fibrous proliferation. Negroes are more predisposed to this type of fibrosis than are Caucasians. There are those who recommend the separate dissection of Tenon's capsule and the conjunctiva and closure of these two tissues in separate layers. Dunnington and McCulloch, in 1956, suggested that such a closure would provide a watertight seal and prevent leakage of the bleb and delayed re-formation of the anterior chamber. Scheie uses this procedure in his operation and noted a considerable number of slow formations of the anterior chamber. McLean has recommended pulling down Tenon's capsule with sutures so that it forms a fold overlying the trephine area, leaving a gap in the capsule above. Laval, in 1955, recommended the use of Gelfilm, which he placed over an occluded iris to separate it from Tenon's capsule and the conjunctiva. He claims that in this way fibrosis is prevented and a widespread drainage area produced. Experimental data provided by Schimek and his associates indicate that Gelfilm may be a factor in increased fibrosis. Certainly this occurred in their experimental rabbit eyes.

Subconjunctival incision into the bleb is rarely sufficient to cure the condition when the intraocular pressure is not satisfactorily maintained through this fibrotic bleb. McCulloch has had some success with this approach. Stanworth has not.

Sometimes massage helps, particularly if it produces a substantial fall in intraocular pressure and increases the size of the drainage bleb. If miotics maintain the intraocular pressure within normal limits, no additional treatment is indicated. Massage may "work" for several months and then no longer be adequate; the patient, therefore, must be watched carefully. The use of steroids does not seem to have any significant influence on the success or failure of these filtration procedures. Stanworth has been experimenting by deliberately excising a piece of Tenon's capsule around the site of the contemplated filtration as a primary procedure. Friedenwald recommended beta irradiation to prevent scar formation in eyes after fistulizing procedures. Cohen, Graham and Fry observed that this tech-

nic improved their results with fistulizing operations performed on Negroes.

Hypotony.—Hypotony has been encountered in all series of fistulizing operations. The tension may be soft from the very beginning of the postoperative period. The blebs may become thin, and the tension remain soft years after the operation. Hypotony undoubtedly favors the development of cataract, and once these opacities have started, correction of hypotony does not stop the progression of lens changes. If one encounters hypotony, attempts to reduce it by cautery of the blebs or other measures may stop filtration to such an extent that the intraocular pressure is no longer controlled. One usually is forced to interfere, however, if the bleb is ruptured, producing a flat anterior chamber, or if there are frequent or annoying changes in refraction. A conjunctival or Tenon's flap can be brought down from above, and this can be anchored to episcleral tissue on each side of the cornea, as suggested by Chandler. A few small cautery points can be placed horizontally near the upper border of the cornea; this is helpful in anchoring the flap to the cornea. Guyton encountered hypotony in only 1 of his 86 operations. Scheie encountered hypotony in 15 patients, or approximately 21 per cent. This is approximately the incidence reported in other series for Elliott trephines, but much higher than that associated with iridencleisis.

Dr. Aguilar Bartolome has stated that phosphoryl choline chloride proved to have value in the treatment of hypotony resulting from lens extraction and trauma. It was ineffective for hypotony following fistulizing operations.

Intraocular Infection. — Late infection after fistulizing operations has been the subject of numerous publications since Wageman's early report in 1913. The estimated incidence varies greatly, according to different authors, from 0.1 to 3.5 per cent. It also varies according to the operation performed, being lowest after iridencleisis than after corneal scleral trephining or the operation of LaGrange. The figures supplied by Kalt and Loisillier are 3.3 per cent after trephining, 6.6 per cent after the operation of LaGrange and 1.4 per cent after iridencleisis. In a total of 464 operations there were 13 cases of late infection (2.8 per cent).

Sugar and Zeckman reviewed the histories of 28 late infections of filtering blebs occurring over the past twenty years. In the majority of the cases the condition resulted from glaucoma operations, trephines showing a higher incidence of late infections than iridencleisis.

Zita, in a ten-year survey of the use of Elliott trephining, noted a high incidence of cataracts and late infections, which in 0.16 per cent resulted in total loss of the eye.

Prophylactic treatment consists of securing a good, thick flap of conjunctiva and Tenon's capsule at the time of operation and of emphasizing to the patient the advisability of seeking advice immediately should there be the slightest sign of inflammatory trouble of the eye or its adnexae. Styes and conjunctivitis should be cultured and specifically treated in all fistulized eyes.

Malignant Glaucoma.—One of the trying situations encountered after glaucoma procedures is forward displacement of the iris lens diaphragm, accompanied by a rise in tension. This is best handled by lens extraction. One can try injection of air into the anterior chamber first, with posterior sclerotomy, but usually lens extraction is necessary. This complication is usually encountered in eyes with narrow angles in which the pressure has not been lowered prior to the operation, yet is more frequently observed after iridec-

tomy than after fistulizing operations, but it may occur after either.

Uveitis.—Iritis is not an uncommon complication of fistulizing procedures, and one must watch carefully to be certain that the pupil is well dilated to prevent the development of posterior synechiae in a position that would embarrass the visual acuity of the patient. The use of local steroids and cycloplegics at the proper time will usually control this disorder. Stallard encountered it in approximately 1 per cent of the patients he treated by anterior flap sclerotomy with basal iridencleisis. The experience of my service with the Scheie procedure in 90 eyes was that moderate to severe iritis was encountered in 9.

Sympathetic ophthalmia was not encountered in any of Guyton's series of iridencleises nor in any of Scheie's or Stallard's patients. In 1954 Mackie and Rubinstein reported a review of the literature in which almost 2,000 iridencleises were listed, including 110 in their own series, with sympathetic ophthalmia occurring in only 4 cases, an incidence of approximately 0.2 per cent.

Experience with Iridectomy and Cautery to Scleral Wound Edges.—Over the past two years I have had the opportunity of evaluating the iridectomy with scleral cautery procedure in 90 eyes, and the results are quite similar to those previously reported by Scheie. Hypotony has been encountered, as has delayed formation of the anterior chamber, which at first was quite worrisome, but apparently many of these eyes have done well in spite of the prolonged interval before the chamber was well formed. Uveitis was encountered in 9 cases, necessitating the vigorous use of cycloplegics and steroids in an effort to quiet the inflammation, break the posterior synechiae or prevent their re-formation. Hyphemas occurred in 8 eyes but appeared not to be related to the eyes in which control was not established. The procedure has been used as a secondary operation when other surgical approaches have failed and has been successful. It is interesting that 2 eyes of 2 patients with essential atrophy of the iris have been controlled for six months after this procedure, though in both cases there was failure to respond to prophylactic iridectomy. Two eyes of the same child, with aniridia, responded favorably after poor response to other procedures (Table 3).

SUMMARY

It appears from the study of recent summaries of fistulizing operations for glaucoma, particularly iridencleisis, that the overall results are good for the control of intraocular pressure. Whether one uses Stallard's procedure or the procedure employed by Guyton, the statistics are approximately the same. Those following the Scheie procedure are also similar (Tables 1 and 2). It is apparent that, as in any type of surgery, complications do occur. They are not always the result of poor technic, but they can be due to errors in judgment or to factors as yet unknown and therefore impossible to control. Some patients do poorly; lens changes develop more rapidly in some than in others, the filtering bleb becomes scarred down. In others, hyphemas or uveitis may develop, or there may be delayed formation of the anterior chamber. The complications are so numerous that one hesitates to operate, but if the indications are clear and the patient has a rising base pressure, with evidence of visual field loss, tomographic evidence of unfavorable change and a definite decrease in the facility of aqueous outflow, the ophthalmologist has no choice and must proceed with surgical intervention. Several procedures are available for the control of chronic glaucoma. There is little to choose between them; complications occur with them all. He should em-

ploy the technic with which he is most familiar, in which he has the most confidence and with which he has had good results. He should have full knowledge of the possible complications and the methods of handling them.

ZUSAMMENFASSUNG

Eine Untersuchung neuerer zusammenfassender Berichte über fistelbildende Glaukomopertionen, besonders die Iridencleisis, ergibt offenbar, dass die Gesamtergebnisse zur Beeinflussung des inneren Augendruckes gut sind. Die Statistiken sind für die Stallardsche Operation ungefähr die gleichen wie für das von Guyton angewandte Verfahren. Die Erfolge der Autoren, die sich der Scheieschen Methode bedienen, sind ebenfalls ähnlicher Art (Tabelle 1 und 2). Komplikationen treten offenbar wie bei allen chirurgischen Vorgängen auf. Sie sind nicht immer die Folge unzureichender Technik, können aber auf falscher Beurteilung oder auf noch unbekannten und daher noch unvermeidlichen Faktoren beruhen. Manchen Patienten ergeht es nicht gut: Linsenveränderungen entwickeln sich bei manchen schneller als bei anderen, ihr Filtrierbläschen vernarbt sich. Bei anderen kann es zu einer Vorderkammerblutung oder zu einer Uveitis kommen, oder die Bildung der vorderen Kammer kann sich verzögern. Es gibt so zahlreiche Komplikationen, dass man zögern mag zu operieren. Wenn jedoch die Indikationen klar sind und der Patient einen ansteigenden Basisdruck mit Verlust des Gesichtsfeldes, tonographisch nachweisbaren ungünstigen Veränderungen und mit einem deutlichen Absinken der Ausflussmöglichkeiten des Augenwassers zeigt, bleibt dem Ophthalmologen keine Wahl, und er muss sich zur Operation entschliessen. Es stehen eine Reihe von Verfahren zur Beeinflussung des chronischen Glaukoms zur Verfügung. Welches davon man wählt, spielt keine grosse Rolle; Komplikationen kommen bei allen vor. Der Augenarzt sollte die Technik anwenden, mit der er am meisten vertraut ist, zu der er dass grösste Zutrauen hat, und die ihm die besten Ergebnisse gebracht hat. Er sollte die möglichen Komplikationen und die Methoden sie zu behandeln genau kennen.

RIASSUNTO

Dallo studio della letteratura recente sulle operazioni fistolizzanti nel glaucoma appare che in generale i risultati sono buoni per quello che si riferisce al controllo della pressione intraoculare. Si con l'operazione di Stallard che con quella di Guyton in risultati sono approssimativamete gli stessi, e cosí pure con il metodo di Scheie. Come in ogni tipo di chirurgia, anche in questa vi sono complicazioni; queste non sempre sono il risultato di una technica scorretta, ma possono essere dovute ad errori di giudizio o a fattori sconosciuti e quindi impossibili da evitare. Alcuni malati vanno male; in alcuni compaiono modificazioni della lente piú rapidamente che in altri; in altri ancora compare ifema o uveite, o vi é una ritardata formazione della camera anteriore. Le complicazioni sono cosí numerose che si esita a operare, ma se vi é un'indicazione precisa all'intervento e la pressione tende ad aumetare, con perdita evidente del campo visivo e diminuzione sensibile nello scarico di liquido, allora l'oftalmologo non ha scelta e deve ricorrere all'intervento chirurgico. Molti sono i metodi a disposizione per controllare il glaucoma cronico, peró vi é poco da scegliere fra di essi perché le complicazioni si verificano in ognuno di essi. Si deve usare la tecnica alla quale si é abituati e con la quale si sono avuti i risultati migliori. Bisogna essere a conoscenza delle possibili complicazioni e dei metodi per trattarle.

RÉSUMÉ

Il ressort de l'étude de résumés récents d'opérations fistulisantes pour glaucomes (surtout en cas d'iridencleisis), que les résultats globaux sont bons en ce qui concerne le contrôle de la pression intra-oculaire. Les statistiques sont à peu près les mêmes, qu'il s'agisse des techniques de Stallard, de Guyton ou encore de Scheie (voir tables 1 et 2), et il est inévitable que l'on se heurte lá aussi à des complications, comme il arrive dans tous les domaines de la chirurgie. Elles ne résultent pas toujours d'une technique déficiente, mais peuvent provenir d'erreurs d'appréciation ou de facteurs encore inconnus, donc impossibles à contrôler. Les difficultés peuvent aussi provenir des réactions des malades (modifications plus ou moins rapides de la lentille, formation d'un hyphéma ou d'une uvéite, retard de formation de la chambre antérieure). Les risques de complications sont si nombreux que l'on hésite parfois à opérer. Mais l'ophtalmologiste n'a pas le choix et doit procéder à une intervention chirurgicale lorsque l'indication est clairement posée (pression de base en augmentation, diminution nette du champ visuel, évidence tomographique de modifications défavorables, etc.).

Nous disposons de plusieurs techniques pour le glaucome chronique, mais aucune n'est exempte de complications. Le spécialiste devrait s'en tenir à celle qui lui est la plus familière, qui lui inspire le plus de confiance et qui lui a déjà donné de bons résultats. Il est très important qu'il soit au courant de toutes les complications possibles ainsi que des méthodes de traitement qui leur sont applicables.

RESUMEN

Considerando las recientes publicaciones sobre el tratamiento quirúrgico del glaucoma, y en especial sobre la iridencleisis, se desprende que se obtienen buenos resultados capaces de controlar la presión intraocular.

Tanto la técnica de Stallard como la preconizada por Guyton ofrecen estadísticas semejantes; también lo son las de Scheie (ver tables 1 y 2). Como en todo tratamiento quirúrgico, es evidente que pueden presentarse complicaciones, pero no siempre se deben a una insuficiencia de la técnica sino a herrores en el diagnóstico o a factores desconeocidos y por tanto incontrolables.

Algunos enfermos llevan un curso malo; se producen cambios en la estructura del cristalino, más deprisa en u nos que en otros, consistentes en el desecamiento y cicatrización de sus vesículas. En otros enfermos aparecen ifemas y uveitis, y en otros casos la cámara anterior del ojo tarda mucho en formarse. Las complicaciones son tantas que surgen dudas a la hora de la intervención; pero cuando la indicación es terminante (presión intraocular en ascenso, reducción del campo visual, cambios desfavorables demostrados por la tomografía, insuficiencia evidente en el drenaje del humor acuoso), el oftalmólogo no tien otra alternativa que la de operar.

En los casos de glaucoma crónico hay varies procedimientos quirúrgicos, pero en todos ellos surgen complicaciones, por lo que nunguno es definidamente el mejor.

Deberá ser empleado la técnica a la que el cirujano esté más habituado, aquella en que tenga más confianza y con la que haya obtenido mejores resultados. Habrá de tener un conocimiento exacto de las posibles complicaciones y sus tratamientos.

SUMARIO

Diz que o estudo de recentes sumarios sobre operações fistulisante nos glaucomas, particularmente a iridoclise mostra existirem melhores resultados no controle da pressão intraocular. Refere que as estatistas são as mesmas quando se considera os

metodos de Stallard e de Guyton, sendo tambem similares as obtidas com o Scheie (Tuadros 1 e 2).

As complicações nem sempre são o resultado de técnica mediocre mas podem ser devidas a erros de julgamento ou a fatores desconhecidos impossiveis de controlar. Em alguns doentes as modificações do cristalino são mais rapidas emquanto que em outros os linfomas e uveites podem ocorrer. As complicações são tão numerosas levam a indecisão operatoria mas se as indicações são evidentes e o paciente exibe pressão elevada com perda da visão, o oculista não tem escolha senão operar. Existem muitos metodos para controle do glaucoma cronico, existindo complicações em todos eles. Aconselha a que seja usada a tecnica em que o oculista tenha maior experiencia e confiança.

BIBLIOGRAPHY

Aguilar, Bartolome, J. M.: Phosphorylcholine Chloride in Ocular Hypotony, Arch. Soc. Oftal. Hisp.-Amer. 18:451, 1958.

Barsky, D. F., and Schimek, R. A.: Evaluation of Absorbable Gelatin Film (Gelfilm) in Cyclodialysis Clefts, Arch. Ophth. 60:1044, 1958.

Chandler, P.: Complications of Surgery, Tr. Am. Acad. Ophth. & Otolaryngol. 53:229, 1949.

Cohen, L.; Graham, F. F., and Fry, W. E.: Beta Radiation as an Adjunct to Glaucoma Surgery in the Negro, Am. J. Ophth. 47:54, 1959.

Dunnington, J. H.: Healing of Incisions for Cataract Extraction, Am. J. Ophth. 34:1756, 1951.

Friedenwald, J.: Some Problems in the Diagnosis and Treatment of Glaucoma, Am. J. Ophth. 33:1523, 1950.

Haisten, M. W., and Guyton, J. S.: Iridencleisis, Arch. Ophth. 61:1727, 1959.

Kalt, M. P., and Loisilliere, F.: Late Infections Following Antiglaucomatous Fistulizing Operations, Ann. Oculist. 191:713, 1958.

Klecker, W. F.: Clinical Experience with Iridencleisis, Klin. Mbl. Augen. K. 130:753, 1956.

Mackie, E. G., and Rubinstein, K.: Iridencleisis in Congestive Glaucoma, Brit. J. Ophth. 38:641, 1954.

McCulloch, C.: The Formation of a Bleb after Filtering Operations, Tr. Canadian Ophth. Soc. 8:97, 1956.

McLean, A. L.: Corneal Scleral Trephining, Am. J. Ophth. 41:399, 1956.

Reese, A. B.: The Iridencleisis Operation for Glaucoma, Arch. Ophth. 34:360, 1945.

Richardson, O. B.: Why Do Filtering Blebs Fail? Tr. Canadian Ophth. Soc. 8:92, 1956.

Rougier, J.; Chavanne, H., and Paufaique, L.: Malignant Glaucoma after Fistulizing Operations, Bull. Soc. Ophthal. Fr. 1:488. 1957.

Scheie, H. G.: Peripheral Iridectomy with Scleral Cautery, Arch. Ophth. 61:291, 1959.

Stallard, H. B.: Anterior Flap Sclerotomy with Basal Iridencleisis, T.O.S.U.K. 77:1669, 1957.

Stanworth, A.: Conjunctival Fibrosis after Filtration Operation, Tr. Ophth. Soc. U.K. 78:43, 1958.

Sugar, H.: The Glaucomas. New York: Paul B. Hoeber, Inc., 1957.

Sugar, H. S., and Zeckman, T.: Late Infection of Filtering Conjunctival Scars, Am. J. Ophth. 46:155, 1958.

Whalman, H. F.: Reopening Technique for Cicatrized Trephination, Am. J. Ophth. 46:890, 1958.

Wyman, G. J., and Hollingshead, E. E.: Subconjunctival Cortisone in Iris Inclusion Surgery, Am. J. Ophth. 36:617, 1953.

Zita, K.: Ten Years Experience with Elliott's Sclerocorneal Trephining, Klin. Mbl. Augenheil K. 133:342, 1958.

Woman's participation in medicine has changed with the evolution of the profession. In ancient and medieval times, woman's contribution to medicine was taking care of the sick; today she also helps the physician. With diligence, dignity, and authority she labors in offices, hospitals, laboratories, statistical departments, technical auxiliary services, administrative offices, complex communication systems, and many other areas of vital importance to the physician and medical progress. Perhaps in no other profession has woman established herself with as much dignity and authority as in the medical profession.

—*Marti-Ibañez*

The Orthopedic and Prosthetic Appliance Clinic Team

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The number of amputees in the present-day population of the United States has risen to such a significant number that their problems are best solved by a group of well-trained specialists operating as a team. The use of such groups has facilitated the proper prescription of prostheses, orthopedic appliances and special shoes, to the increased satisfaction of the patient, the prescribing physicians and the purchaser. Operating surgeons who are untrained in prosthetics should avail themselves of local prosthetic team facilities so that their patients will receive the optimum prosthesis. It has been demonstrated that the amputee's problem can be better interpreted by an assembled team of specialists rather than by individual effort.

THE number of amputees in the United States at present has risen to a significant height as a result of two world wars, the Korean conflict, increased military activities and a vast number of automobile and industrial accidents. The numerous types of land mines and high explosives employed in modern warfare and the high speeds associated with vehicular accidents have caused many fatalities and a high incidence of loss of limbs. Rapid evacuation of battle wound casualties, improved military medicine and modern chemotherapeutics, however, have saved many lives, including those of persons with traumatic or operative amputations who otherwise would not have survived to augment the amputee population. Today there are some twenty thousand service-connected amputee veterans requiring prosthetic aid, but an even greater artificial limb problem is created by the twenty-five to forty thousand new amputations occurring each year as a result of automobile and industrial accidents. The amputee problem and the associated need for artificial limbs have become an important segment of the medical care program.

In early 1949 the Veterans Administration offered an indoctrination course at the New York City Regional Office for the training of personnel to organize special orthopedic and prosthetic appliance clinics, in order to provide the best possible prosthetic service for its amputee veterans. It was recognized that a specially trained team of specialists, each concerned with an individual phase of the prosthetic and rehabilitation problem, could provide infinitely better service than each specialist working alone by the individual consulta-

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tion method previously employed. On May 13 such a clinic was established in Washington, D.C., under my direction, and since then additional clinics have been organized in all sections of the United States, including Hawaii, thirty-five in all.

Purposes.—The purposes of the orthopedic team operating in a special clinic are as follows: 1. To provide adequate medical supervision of fitting and adjustment of orthopedic appliances. 2. To provide proper training and treatment relative to the furnishing of orthopedic appliances. 3. To act as an extension in field testing and appraisal of orthopedic devices resulting from research of the Veterans Administration and the National Research Council. 4. To effect an economy of expenditures by the United States Government in the issue and maintenance of orthopedic appliances.

In addition, the clinic team functions in cooperation with the hospital services, making recommendations for surgical correction of deformities when feasible, and in other instances aiding in the proper care of amputees, i.e., preventing deforming contractures and undesirable stumps that would make the fitting of prostheses a difficult problem.

Prior to the establishment of the orthopedic and prosthetic appliance clinic team, there was no attitude of cooperation between the limb fitter and the prescribing physician, and the mutual respect now present did not exist. Usually, the physician referred the amputee to a nearby prosthetist with instructions to "give him an artificial limb." Most of the decisions were left to the limb fitter, and he made alterations as he desired. Now the prosthetist receives a full prescription, similar to any medical prescription, with an itemized list of components of the artificial limb, and he is instructed to communicate with the surgeon before he makes any major alterations in such a prescription.

Composition of a Typical Prosthetic Team.—A typical orthopedic and prosthetic appliance clinic team is composed of a group of specialists in the various fields of rehabilitation and prosthetics, designed to analyze the problems of a handicapped person. As evolved by the President's Advisory Committee on Artificial Limbs, it comprises an orthopedic surgeon, physiatrist, physical therapist, administrative assistant, orthotist, one or more prosthetists and an occupational therapist. In addition, special consultants should be available, including a clinical psychologist, psychiatrist, vocational guidance officer and social service worker.

Orthopedic Surgeon. — The orthopedic surgeon is the chief of the clinic team and must be well experienced and trained in the prescription and application of orthopedic appliances, shoes, and prostheses. The Veterans Administration has been careful to select orthopedic consultants who are not members of the regular staff, in order to free them from influence or coercion by administrative management or other political pressures. Although the orthopedist usually operates in a regional office or regional medical facility, he is directly responsible only to the Director of the Prosthetic and Sensory Aid Service in the Central Office of the Veterans Administration, and not to the local administrative official. Because of constant progress and the development of new orthopedic appliances and prosthetic components, a proper prescription can be written only by an orthopedist who is experienced and trained in prosthetics, and who has participated in periodic training courses and experimental programs. He must be familiar not only with the conventional prostheses and appliances but also available new devices, so that he may prescribe those aids for the handicapped which will provide maximum comfort and functional value. The surgeon who is experienced in prosthetics is cognizant of the advantages and limitations of the various prosthetic

appliances and will be able to approximate more closely the desires and needs of the amputee than could one without special knowledge. This can best be accomplished by interpretation of the problem by an assembled team rather than by individual effort, each member aiding the orthopedic surgeon to prescribe a device that will secure the best cosmetic and functional value for the wearer.

The orthopedic consultant is responsible for medical supervision of all clinic activity, and he is primarily responsible for the writing of the prosthetic prescription. It is his responsibility to conduct an examination of the individual patient; to provide complete and accurate medical records; to direct, supervise and prescribe the treatment for fitting the orthopedic appliances and training in their use; to cooperate with authorized research programs; and to prescribe corrective surgical treatment when indicated. By close coordination between the orthopedist and local hospital facilities, the patient can be referred back to the prosthetic team after the prescribed operation, for follow-up care and prescription of the modified prosthetic device which will then be indicated.

The surgeon should consult with all members of the prosthetic team, so that the final prescription will represent the best pooled thought of the entire group. In addition, he should prescribe and supervise physical and occupational therapy, training, and exercises and should make the final appraisal of the results.

Physical Therapist.—In the first Pilot Clinics another physician, a physiatrist, was assigned to the team as the orthopedic surgeon's first assistant. In most clinic programs today, however, this member of the team has been eliminated and a portion of his duties assumed by the physical therapist. In some civilian rehabilitation programs the directive role has been assumed by well-trained physiatrists. It is the opinion of the American Academy of Orthopedic Surgeons that rehabilitation of orthopedic problems should properly be directed by an orthopedic surgeon, who is best qualified by his training to understand all facets of these problems. The physical therapist functions as the orthopedist's first assistant in the examination and treatment of the veteran, aiding him in assaying the orthopedic deformities, such as contractures, muscle atrophy, weakness and limited joint motion. Upon direction of the orthopedist he performs manual or electrical testing and reports his observations to the Clinic chief before the final prescription is written. He aids the orthopedist in determining the proper indications for physical therapy and then schedules the therapy as required. In many instances, where an occupational therapist is not available, he assumes these duties as well and directly supervises all of the training of the amputee in the use of his new prosthetic device.

The physical therapist should also advise the surgeon, when the prescription is being formulated, of anticipated training problems and possible solutions. During the training sessions he may call the surgeon's attention to any fitting or harnessing difficulties that have become evident and may require modification of the prosthesis. In such cases the patient is returned to the Clinic, so that modifications may be ordered in conjunction with the prosthetist.

The therapist is also of great aid to the orthopedist in making a final evaluation and check-out of the prosthesis and in completing the forms required by the various research programs in which the Clinic participates. The therapist on a prosthetic team must be one with special training in the field of prosthetics, since the average therapist is unfamiliar with this subject. In addition, the therapist maintains a duplicate record and brief abstracts of the veteran's treatment folder directly in the Clinic; this is especially

helpful when the veteran's folder has been detained elsewhere or is otherwise not available.

Prosthetic Representative.—The prosthetic representative or administrative assistant is a Veterans Administration employee who performs all necessary liaison pertaining to administrative matter. It is his duty to have all administrative records available; to ascertain in advance the eligibility of the veteran for the prosthetic device; to provide and supervise the physical layout of the Clinic with regard to all required equipment; to provide stenographic aid; to counsel veterans as to their rights and the benefits of the service program, and to arrange for their Clinic and follow-up appointments. He should relieve the physician of as much paper work and administrative detail as possible. It is also his duty to notify veterans of the availability of new designs and mechanical features that may be of benefit in any particular case. Usually the Administrative Assistant is an amputee himself and this gives him keen insight into the amputee's situation and establishes a bond of sympathy between the veteran and the Clinic. He provides a means of direct association between the prosthetic team, the limb manufacturers and the Veterans Administration supply facilities, and supervises the financial transactions.

Prosthetist.—The prosthetist is a valuable member of the Clinic team, since he fabricates the prosthesis and is present with the amputee at the fitting and examination. He can be of great aid to the orthopedic surgeon because of his experience in using various prosthetic components and devices in other and similar cases and because of his close association with the veteran from previous personal contacts in his shop. He may be able to advise the orthopedist of various peculiarities of the veteran that may alter the prescription and modify the Clinic team's approach by indicating problems not otherwise apparent. The prosthetist also aids in the conduct of research studies and functional evaluations, usually supplying the research prosthetic components.

Generally, the Clinic is attended by a representative of each local manufacturer of artificial limbs. At no time is the veteran directed to go to any particular shop. In our Clinic each prosthetist is encouraged to express freely his recommendations and his criticisms of all prosthetic devices, whether of his own manufacture or not, so that the amputee may benefit from the opinion of the entire team.

Occupational Therapist. — The clinic does not always have the services of an occupational therapist, but when one is available she can be of definite assistance in training the amputee in use of the prosthetic appliance and administering occupational therapy. As a result of such training, the need of special devices to assist in the patient's occupation may become apparent and can be supplied.

In formulating a prosthetic prescription, the amputee himself should be considered a temporary member of the Clinic team, as his opinions and desires are highly important to the ultimate success of any prosthesis prescribed. Many amputees, by association with other amputees and through personal experience, acquire certain prejudices and obsessions that may alter or modify a prescription. Occasionally, because of the veteran's severe psychoneuroses or obsessions, one is not able to prescribe the type of prosthesis indicated, lest it jeopardize the acceptance of the prosthesis. In some cases, when the psychoneurotic trend is only moderate, the Clinic team presentation sufficiently impresses the veteran to cause him to modify his own desires and accept the prosthesis the team believes best for his particular amputation.

In the solution of special problems the prosthetic clinic has access to other con-

sultants, such as a psychiatrist or clinical psychologist when a neurotic situation exists, or a vocational guidance officer to help select terminal devices for an arm prosthesis to aid in job training.

Proper physical facilities greatly facilitate the operation of a prosthetic clinic. A two-room suite is desirable, with a dressing room to prepare for the examination and an adjacent examining room of sufficient size and length, approximately 20 by 40 feet, to provide a long walking area, in order that gait characteristics may be noted. Provision of tightly knitted swimming trunks for lower extremity amputees will permit observation of the entire prosthesis in both stance and gait. Such trunks are easily laundered and provide adequate covering.

Additional Functions of the Clinic Team.—Since its establishment in 1949 the prosthetic team has proved its merits to the satisfaction of the veteran, the limb manufacturing companies and the Veterans Administration. The amputee has learned that by utilizing this special Clinic he is assured the best possible prosthesis and prosthetic service for his amputation. The number of visits required has been drastically reduced. Prostheses must measure up to proper standards of workmanship and material. Routine checkup examinations result in increased length of service and comfort and better maintenance, with necessary alterations and adjustments to make the device more serviceable. New prostheses are prescribed only when definitely indicated and only after condemnation of an unserviceable prosthesis, whereas, previously, artificial limbs were ordered by almost any physician in the outpatient service and frequently were ordered as a matter of expediency, with little or no follow-up care. Often the prosthesis was unsatisfactory, and its only use was to fill up closet space. Now the veteran must report to our Clinic to receive his new prosthetic or orthopedic device and receive a complete check-out at that time, instead of having the new prosthesis mailed to him with no knowledge of its fit or serviceability. By such measures the Clinic team has proved that its cost is far outweighed by the reduced expenditures resulting from its maintenance.

The Clinic team may be asked to decide whether special orthopedic devices are indicated in questionable cases. This includes prescription of wheelchairs for partially paralyzed veterans; prescription of canes and crutches; prescription of orthopedic shoes and braces, etc. In some instances the motivations of the veteran may be suspect; the request for orthopedic shoes or braces, for example, may be an effort to increase his disability rating. The Clinic team is better qualified to make decisions in such cases than is a doctor in the outpatient service, who may be under various political or administrative pressures, or who may follow the line of least resistance to satisfy an aggressive and bothersome veteran. In some instances, such visits have resulted in elimination of previously issued special orthopedic shoes or braces by recommendations for surgical correction of a deformity, with resultant benefit to the veteran.

Prosthetic Problem of the Upper Extremity.—One of the most significant contributions of the prosthetic team has been its aid to upper extremity amputees, who notoriously have been slow to accept prostheses because of the complicated problems involved in their use. This is in contrast to lower extremity amputees who are almost forced to accept a prosthesis for walking and weight bearing. The unilateral upper extremity amputee frequently dispenses with the prosthesis, adjusting himself to the use of one arm and using the stump as a paperweight or, if he possesses an elbow joint, using this joint's function to assist his intact arm. Owing to the remarkable progress in upper extremity prosthetics from the research programs

currently conducted by the University of California at Los Angeles, New York University and the National Research Council, a much more acceptable prosthesis has become available to the upper extremity amputee. The prosthetic clinic has advised amputees of available new prostheses and supervised their fitting and the training so necessary to successful function. Today there is no longer any excuse for an empty coatsleeve, as even a cosmetically good arm can be fitted if a functional prosthesis is not acceptable to the veteran. For bilateral upper extremity amputees even greater advances have been made, including the appearance of various types of terminal device and other components to aid in the amputees' rehabilitation.

The Clinic Team in Research.—An important function of the Clinic has been its participation in research programs to evaluate new items. Military patients are unsuitable for such a program because of difficulties in proper follow-up studies due to transfer, discharge from the service, etc., and their strong motivations, such as their desire for discharge, their resentments, etc., which might color their opinions of the value of such devices.

The prosthetic Clinic in Washington has been so fortunate as to have been selected for participation in most of the research programs, in close association with the Army Prosthetic Research Laboratory in Washington. A brief summary will demonstrate the value of the prosthetic clinic in research activities.

The Above-Knee Suction Socket Prosthesis Program: Of the 11 experimental users of this prosthesis in 1949, 9 were completely successful and 1 is still wearing a suction socket prosthesis. Some veterans were initially refused prostheses because of apparent contraindications, but later they became successful suction socket wearers as a result of our increased experience.

Studies to Reduce Perspiration of the Stumps: Our Clinic has experimented with the use of various pharmaceuticals, such as 0.1 of 1 per cent formaldehyde, the use of deodorant preparations incorporated into a cream base for application to the stump, iontophoresis of aluminum salts, and silica gel bags to absorb excess moisture. This remains an unsolved problem, and the optimum product has yet to be found.

Survey of Orthopedic Braces: Twenty veterans using long-leg braces, short-leg braces, arm braces and back braces were selected at random and asked to report to the Clinic for an unspecified reason. Of the 20 it was found that 7 did not require a brace, and 4 of these were not even wearing their braces when they reported to the Clinic. In 1 case operation was recommended and eliminated the need of a brace.

Field Evaluation of the APRL Hook: The benefits and hindrances involved in the use of the APRL hook were evaluated and reported to the central office, note being taken of the benefits of differential pressure and the aid of the free-wheeling feature, but there was early fatigue from increased muscle action to activate both opening and closing of the hook.

Study of Length of Service of Artificial Limbs: In 1951 we made a study of the need of replacement of artificial limbs prior to the standard three-year period of use previously established. All applications for new limbs prior to expiration of the three-year period were referred to our Clinic for evaluation. It was noted that in certain occupations replacement was sometimes required within the three-year period, but that in other cases, by proper maintenance and adjustment, the period could be extended to more than three years.

Survey of Excessive Issue of Orthopedic Shoes: Existing regulations state that a veteran with a foot deformity should have two pairs of serviceable orthopedic shoes in his possession at all times. A study to

Orthopedic and Prosthetic Appliance Clinic, Washington, D.C., 1952-1957

Period Covered	*No. of Clinics*	*Scheduled Appointments*	*Total No. Examined*	*Average No. Scheduled Per Clinic*	*Average No. Failing to Report Per Clinic*	*Average No. Examined Per Clinic*
7/1/52 to 6/30/57	36	236	195	6.63	1.20	5.44
7/1/52 to 6/30/54	52	357	301	6.74	1.06	5.68
7/1/54 to 6/30/55	52	473	361	9.10	2.16	6.94
7/1/55 to 6/30/56	50	449	395	8.99	1.09	7.91
7/1/56 to 6/30/57	52	503	433	9.67	1.35	8.33

determine serviceability was made in 1952, after repeated observations had noted that the shoes brought into the clinic for condemnation were usually very dilapidated and minus serial or date markings, so that they could have been issued several years before. As veterans were in this way obtaining more than the authorized two pairs of shoes, recommendations were made for proper marking and dating of each new issue of orthopedic shoes, so that they could later be identified when presented for condemnation. This has now been adopted as standard procedure and has been of aid in establishing the serviceability to be anticipated from special shoes.

Field Testing of Upper Extremity Prostheses: The Washington Clinic was one of several selected for field testing of upper extremity prostheses in 1953, after our team had completed an intensive course in upper extremity prosthetics at the University of California at Los Angeles. The testing was done in close conjunction with a representative from New York University and resulted in an affirmative evaluation of the laminated plastic type of upper extremity prosthesis and the APRL hook and hand. Special prescription forms and check-out forms were designed as a result of these studies.

Field Check of the Navy Above-Knee Prosthesis with Navy Variable Cadence Knee Joint and Navy Functional Ankle: In conjunction with New York University we engaged in the field testing of this experimental prosthesis. It was found that the special components were unsatisfactory for general use because of poor maintenance and technical reasons.

Field Testing of the Quadrilateral Suction Socket and Sach Foot: This study is currently in progress, utilizing knowledge gained in a course in above-knee prosthetics at New York University in 1956. The Sach foot appears to have definite value in special situations.

Evaluation of "Space Type" Shoes: This study is now in progress. Its purpose is to evaluate the functional and wearing quality of space type shoes (Allan-Murray shoes), for veterans with serious foot deformities who cannot be fitted adequately with the regular orthopedic shoes.

From this brief synopsis it is evident that the Clinic team functions as a valuable arm of our research program by providing necessary field testing of new devices. Future developments will be successful only through such cooperative effort.

Statistical Report. — The activities of the Orthopedic and Prosthetic Appliance Clinic of Washington, D.C., are shown in the accompanying table. Whereas orginally there was considerable skepticism on the part of both veterans and limb manufacturers of the value of such a clinic, it has now been accepted wholeheartedly, with sincere enthusiasm, by all concerned. The representatives of the limb companies consider the Clinic one of their best assets.

The professional staff of the Medical Division of the Veterans Administration, who originally were reluctant to refer patients to the Clinic and attempted to handle such problems themselves, now rely on us completely and consider our Clinic absolutely essential. The veterans have long learned to look forward to the regular weekly Clinic, and they keep our schedule filled for several weeks in advance. The average attendance has steadily grown, and the number of cancellations and absentees has steadily diminished. The usual Clinic conference lasts two and one half hours, with 8 to 10 patients examined without hurry and with full study and discussion of each individual case.

Three examples of the "problem cases" will serve to illustrate the value of the prosthetic Clinic team.

Fig. 1.—Quadrilateral amputee: bilateral amputation below elbow; right leg amputated below knee and left leg above knee.

REPORT OF CASES

CASE 1.—R. L. S., a 27-year-old veteran (Fig. 1), the first quadrilateral amputee of the Korean conflict, with bilateral below-elbow amputations, above-knee amputation on the right and below-knee amputation on the left, was given considerable rehabilitation training at Walter Reed Hospital, followed by vocational guidance and training for work in the Machine Records Division, using IBM equipment. He was referred to our Clinic for selection of proper terminal devices for his arm prostheses to enable him to work with the IBM equipment. The APRL device with which he had been supplied requires two motions, one to open and one to close the hook, and was not suitable in this particular case. After consultation with his vocational guidance officer before our entire Clinic team, he was supplied with one Northrop two-load hook, which has a coiled spring device to effect closure after voluntary opening and a Dorrance No. 5 hook for the other prosthesis. In his case the hooks were covered with Neoprene to prevent slipping of papers.

When last seen, in October 1957, he was working regularly and had found the terminal devices functional for his job. He was walking with the aid of one crutch, for added stability, but was able to walk without a crutch for short distances. This is an example of guided assistance that converted a severely wounded veteran into a self-sufficient citizen with economic independence, despite his unusual handicaps.

CASE 2.—G. L. O., a 39-year-old veteran of World War II (Fig. 2), had a short, badly scarred, irregular above-knee amputation stump, limited hip motion and recurrent osteomyelitis of the pelvis. He was first referred to our Clinic in 1954 after considerable difficulties with breakdown of his knee friction apparatus, recurrence of osteomyelitis from unbalanced pressure in the inguinal region and frequent maintenance problems. Because of the patient's strong desire for an adjustable knee mechanism, this was first incorporated into a prosthesis, but it was removed later, after frequent maintenance difficulties had diminished its value. A modified suction socket pattern was substituted for the old plug socket, plus a pelvic band and single axis hip joint, in order to pull the stump within the socket as far as possible and place maximum weight bearing

on the ischial seat. This has proved eminently satisfactory, and when last seen, in October 1957, the patient was wearing the prosthesis regularly and was having no difficulty with his stump. He has also been using PHisohex regularly for cutaneous hygiene with few incidents of skin irritation.

The use of a comfortable and functional artificial limb was especially valued by this veteran, who is a practicing attorney and requires the limb for a presentable appearance in his court and business associations. Incidentally, he informs us that since his prosthetic problem has been solved his practice has shown a considerable increase.

CASE 3.—C. W. S., a 34-year-old veteran (Fig. 3) with a 3-inch (7.5 m.) below-knee stump from shrapnel wounds in World War II, had been wearing a bent-knee type of prosthesis since 1946, and had had considerable difficulty with maintenance problems of the ankle and foot components. In January 1955 the Clinic team prescribed a slip socket type of BK prosthesis, utilizing the patient's own knee joint in gait control, with a partial ischial weight-bearing corset with a filler to compensate for severe flesh defects. After a lengthy trial period, including physical therapy training, the patient was unable to walk satisfactorily with this prosthesis and returned to the use of his bent-knee device. In January 1956 the slip socket feature was removed and a hard socket substituted, with a full ischial weight-bearing corset. The patient cooperated in an intensive course of physical therapy and made steady progress, until finally he was able to wear the new prosthesis regularly and entirely discarded the old bent-knee prosthesis. When last seen, in October 1957, he was so well satisfied that he requested another prosthesis of similar construction, stating that he had no "spare," as he no longer wished to use his old type prosthesis. He has had no unusual maintenance problem, and his stump has remained in excellent condition, aided by the use of PHisohex for regular cutaneous hygiene. This is an example of the team approach in rehabilitation of an amputee by prescribing the most suitable prosthesis for his particular stump.

Fig. 2.—Short above-knee amputation stump with severe scarring.

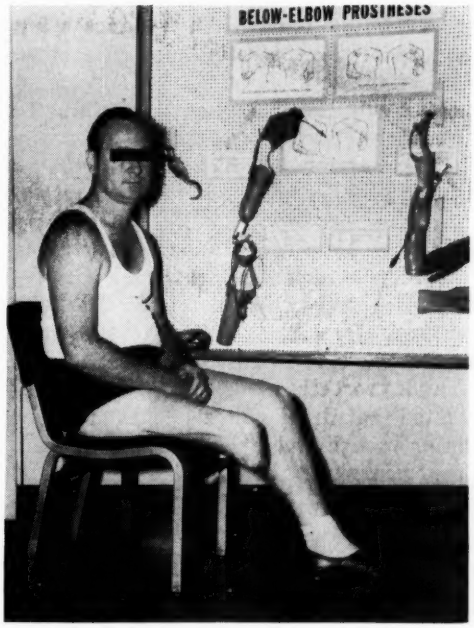

Fig. 3.—Very short below-knee amputation stump with flexion contracture deformity.

SUMMARY

The number of amputees in the United States population has now risen to such a significant height that the patient's problems are best solved by a group of well-trained specialists operating as a team. The use of such groups has facilitated the proper prescription of prostheses, orthopedic appliances and special shoes, to the increased satisfaction of the patient, the

prescribing physicians and the purchaser.

The prosthetic team consists of an orthopedic surgeon, a physical therapist, one or more prosthetists, an orthoptist, an administrative assistant and an occupational therapist, plus special consultants available, as required. It has reduced need for expensive alterations and replacements of prostheses, increased comfort and function in the use of prostheses, reduced delay in proper care of amputees, increased the standards of manufacturing and workmanship in prosthetic appliances and aided in the evaluation of new research devices.

Through the prosthetic clinic team approach, rehabilitation of the amputee has made definite progress. An ever-increasing number of prostheses is being prescribed through a result of the team concept, and undoubtedly this number will continue to increase. Since its inauguration by the Veterans Administration, private clinic groups have been formed in various rehabilitation centers throughout the country and have given excellent service to their communities. Operating surgeons who are untrained in prosthetics should avail themselves of local prosthetic team facilities so that their patients will receive the optimum prostheses. It has been demonstrated that the amputee's problem can be better interpreted by an assembled team of specialists rather than by individual effort.

RIASSUNTO

Il numero di amputati nella popolazione degli Stati Uniti ha raggiunto, oggi, una cifra tale da imporre che i loro problemi vengano risolti da un gruppo di specialisti che lavorino assieme. L'impiego di tale gruppo facilita la prescrizione della protesi più adatta, così da soddisfare ognuno. Esso consta di un chirurgo ortopedico, di un fisioterapista, di uno o più protesisti, di un ortottico, di un assistente amministrativo, di un terapista oltre ad altri consulenti se necessario. Si riduce in tal modo la spesa per le protesi da riparare o sostituire, si aumenta il beneficio di esse, si riduce ogni ritardo nella cura degli amputati, si migliora la qualità delle protesi e si stimola la costruzione di nuovi strumenti. Attraverso l'impiego di tali gruppi specializzati si è ottenuto un indiscutibile progresso nella riabilitazione degli amputati; vengono prescritte protesi in numero sempre crescente, e tale numero è probabilmente destinato ad aumentare continuamente. Formato il primo gruppo presso la Veterans Administration, se ne sono formati altri in tutto il paese, con grandi benefici per la comunità. I chirurghi che non abbiano esperienza nel campo delle protesi possono ricorrere agli specialisti del gruppo locale onde giovare nel modo migliore ai loro malati. E' ormai dimostrato che il problema degli amputati può essere risolto nel modo migliore da un insieme di specialisti riuniti in gruppo piuttosto che da un solo individuo.

ZUSAMMENFASSUNG

Die Zahl der Amputierten in der heutigen Bevoelkerung der Vereinigten Staaten ist so erheblich angestiegen, dass ihre Probleme am besten von gut ausgebildeten Spezialisten, die als eine Gruppe zusammenarbeiten, geloest werden. Die Arbeit solcher Gruppen ermoeglicht die richtige Verschreibung von Prothesen, orthopaedischen Apparaten und Spezialschuhen und fuehrt zur erhoehten Befriedigung des Kranken, des verschreibenden Arztes und des Kaeufers.

Die Arbeitsgruppe besteht aus einem orthopaedischen Chirurgen, einem Spezialisten der physikalischen Therapie, aus einem oder zwei Prothetikern, einem Spezialisten in mechanischer Uebung des Auges, einem Verwaltungsbeamten und einem Beschaeftigungstherapeutiker und je nach Bedarf aus besonderen Konsiliarien. Die Arbeit solcher Gruppen hat die Notwendigkeit kostspieliger Umaenderun-

gen und Auswechslungen von Prothesen herabgesetzt, die Bequemlichkeit und die Funktionstuechtigkeit bei der Benuetzung von Prothesen erhoeht, die Zeitdauer bis zur ordentlichen Versorgung der Amputierten verkuerzt, die Qualitaet der Prothesenfabrikation verbessert und zur Auswertung neuer Forschungsarbeiten beigetragen.

Die Wiederherstellung der Amputierten hat durch die Verwendung klinischer Prothesenarbeitsgruppen sichtbare Fortschritte gemacht. Eine staendig wachsende Zahl von Prothesen wird auf Grund der Erfahrungen der Arbeitsgruppe verschrieben, und es ist anzunehmen, dass diese Zahl weiter zunehmen wird. Seit die Veteranenverwaltung diese Arbeitsmethode eingefuehrt hat, haben sich in verschiedenen Wiederherstellungszentren im ganzen Lande private klinische Arbeitsgruppen gebildet und ihren Gemeinden ausgezeichnete Dienste geleistet. Operierende Chirurgen, die in der Prothesenarbeit nicht speziell ausgebildet sind, sollten sich dieser lokalen Arbeitsgruppen bedienen, um ihren Patienten die beste Form der Prothese zugaenglich zu machen. Es hat sich herausgestellt, dass das Problem des Amputierten von einer Arbeitsgruppe von Spezialisten besser verstanden und geloest werden kann, als durch die Bemuehungen einer einzelnen Person.

RESUMEN

El número de amputados en la población actual de los Estados Unidos ha aumentado hasta constituir una cifra importante cuyos problemas se resuelven por un grupo de especialistas bien entrenados actuando en equipo. La consecuencia ha sido la prescripción adecuada de prótesis, aparatos ortopédicos y zapatos especiales lo que representa una satisfacción para el enfermo, el médico y el fabricante.

El equipo protésico consta de un cirujano ortopédico, un terapeuta físico, uno o más protésicos, un ortopédico, un ayudante administrativo y un terapeuta ocupacional, más los especialistas para consulta que sean requeridos. Esto ha reducido la necesidad de reparaciones caras y de sustituciones de las prótesis, ha aumentado en confort y la función con el uso de los aparatos, ha reducido el tiempo perdido en el cuidado de los amputados, ha mejorado considerablemente los standards de construcción de los dispositivos ortopédicos y ha contribuído al progreso e investigación de nuevos dispositivos.

Estos equipos protésicos clínicos han contribuído a un progreso definitivo en la rehabilitación de los amputados. Como consecuencia del concepto de equipo ha aumentado el número de prótesis prescritas y continuará aumentando. Desde la inauguración del Veterans Administration se han formado nuevos equipos en todo el país que prestan excelentes servicios a sus comunidades. Los cirujanos que no están entrenados en estos problemas tienen a su disposición medios de orientación para que sus enfermos puedan beneficiarse de las mejores prótesis. Ha sido pues demostrado que los problemas de los amputados pueden ser interpretados hoy mejor que antes por un equipo especializado y por los esfuerzos individuales.

RÉSUMÉ

Le nombre des amputés a augmenté dans une très grande proportion parmi la population des Etats-Unis, et c'est un groupe de spécialistes entraînés, travaillant en équipe, qui est le plus à même de résoudre des problèmes ainsi posés. Ce sont de tels groupes qui ont facilité la prescription judicieuse de prothéses et d'appareils orthopédiques, à la satisfaction croissante des patients, des médecins traitants et des fabricants.

Ces équipes comprennent un spécialiste en chirurgie orthopédique, un médecin traitant, un ou plusieurs spécialistes en prothèses, un orthopédiste, un auxiliaire

administratif et un spécialiste en médecine professionnelle, à quoi il faut ajouter en cas de nécessité, un certain nombre de médecins consultants à disposition. Cette méthode a diminué le nombre des modifications et réajustements de prothèses toujours coûteux, elle a augmenté le confort et le bon fonctionnement des prothèses, facilité le traitement plus rapide des amputés, accru les standards de fabrication et d'exécution des appareils et contribué à la réalisation de nouveaux appareiels.

Grâce aux équipes cliniques de prothèses la réhabilitation des amputés a fait des progrès décisifs. Elles permettent la prescription d'un nombre toujours plus élevé de prothèses. Depuis leur création par la Veterans Administration, des groupes cliniques privés ont été formés dans de nombreux centres de réadaptation à travers tout le pays, qui ont déjà rendu d'excellents services. Les chirurgiens non entraînés dans cette spécialité doivent cannaître les facilités que peuvent leur procurer les équipes locales à leur disposition, d'être à même d'offrir à leurs patients les meilleures prothèses. Il a été prouvé que les problèmes des amputés sont résolus de façon beaucoup plus aisante par une équipe spécialisée que par des efforts individuels.

SUMARIO

O numero de amputados atualmente nos Estados Unidos tem se elevado muito de modo que seus problemas são melhor resolvidos por um grupo de especialistas bem treinados. Esse grupo tem facilitado a indicação adequada de proteses, aparelhos ortepedicos e sapatos especiais.

O team de protese consiste de um ortopedista, o fisioterapeuta, um ou mais proteticos, um assistente administrativo, um terapeuta de medicina ocupacional, alem de consultantes especiais, tantos quanto necessarios.

Esse sistema de trabalho reduziu despesas, substituições de proteses, aumentou o conforto dos pacientes e seu ganho funcional e auxiliou a availiação de pesquisas novas sobre a protese.

Os progressos da rehabilitação dos amputados melhorou grandemente e o numero de prescrições aumentou e continua aumentando sempre. Esse serviço que foi organisado no hospital de veteranos está se difundindo pelo país com resultados muito satisfatorios. Ficou demonstrado que o problema do amputado se torna de melhor solução quando examinado e resolvido por uma equipe de especialistas do que por um esforço individual.

REFERENCES

1. Veterans Administration: Tentative Program for Pilot Orthopedic Clinic. Washington, D.C.: Bull. Veterans Administration, April 22, 1949.

2. Veterans Association: Prosthetic Research. Washington, D.C.: Bull. Veterans Association 1B 10-5-24, February 1951.

3. Department of Engineering, University of California at Los Angeles: Manual of Upper Extremity Prosthetics. Los Angeles: University of California, 1952.

The thermometer habit is a definite sequel of typhoid, especially in children. Throw away the thermometer, discharge the nurse, soothe the parents.

—*Osler*

Plastic and Reconstructive Surgery

The Correction of Congenital and Acquired Ptosis of the Upper Eyelids

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The embryonic and anatomic aspects of the eyelids are discussed to determine, if possible, the cause of congenital ptosis.

The author recommends a procedure introduced, to the best of his knowledge, by the late Dr. John Staige Davis, which he himself has employed since the '20s. Since various methods involving shortening the skin of the eyelids and/or utilizing the ocular muscles have proved unsatisfactory, he has concluded that the best and most lasting results are obtained by using fascia taken from the patient and employing the frontalis muscle to operate the ocular levator. This technic also offers the patient a good cosmetic result and improves the vision.

The acquired type of ptosis should not be operated on until it is reasonably certain that there will be no improvement without it. The congenital type should not be surgically treated until the patient is more than one year old and able to control his voluntary movements.

THE inability to elevate the upper eyelids by the normal function of the levator muscles of the eyes causes ptosis.

The loss of function may be so great that the pupils are completely covered, preventing light from entering. This may result in some loss of vision in one or both eyes. In an effort to permit greater opening of the eye slits, the lower lid tends to fall away, giving the impression of exophthalmos. In an effort to see, the patient lifts his head backward and opens his mouth, which gives him a rather ridiculous appearance. There may be postural deformities in the spine because of the elevation of the head.

Ptosis may be congenital or the result of some illness. The congenital type is the most common and is usually bilateral. The acquired type can result in conjunction with exanthematous disease or turbulent pregnancy, or it can be idiopathic.

The eyes may be normal and overnight the patient may lose the power to elevate the eyelids. Every examination of the spinal fluid, blood and so forth fails to reveal anything. There may not even be an elevation of temperature, and the patient has no symptoms of illness. Ptosis of this type will gradually clear up in about a week or ten days, leaving no ill effects. One may also encounter this type of ptosis

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with some elevation in temperature and symptoms indicating poliomyelitis. In most cases of this type it will clear up, but in some a residual ptosis is left. This type is observed for some months, and exercises are prescribed. If after a year there is no marked improvement, surgical intervention can be considered.

A review of the embryonic aspects of the area may offer some information concerning the congenital type of ptosis. Why there should be selective damage to the nerves enervating the levators is a matter of conjecture. During the seventh week of gestation the eyelids begin to develop as folds of skin growing back over the cornea. Having started to form, they close over the eyes rapidly, usually meeting and fusing by the end of the ninth week. This fusion involves only the epithelial layers of the lids and the eyelashes. The glands along the margins of the lids

Fig. 1.—*A*, marked congenital ptosis. Eye slits are smaller than normal. Note marked wrinkling of forehead. *B*, note eye slits are smaller than normal. Marked wrinkling in forehead even at rest, because of years of effort. *C*, one week after operation. Note fold in eyelid, which is not visible in the previous pictures. *D*, eyes closed. This is important lest there be irritation of cornea. *E* and *F*, result of fascial transplant one month after operation. There is still some edema. Question of making eye slits larger was next considered.

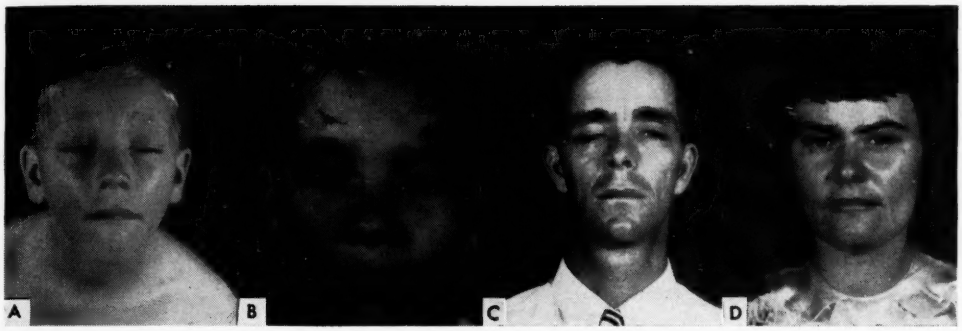

Fig. 2.—*A*, congenital ptosis of eyelids. Eyes can barely be opened. *B*, one week after operation. Note folds in eyelids. It is important to pass fascia at this level to secure a normal appearance of eyelids. *C* and *D*, father of patient has marked ptosis, while mother is normal. When there is a congenital tendency, deformity is transmitted to the male, rarely to the female.

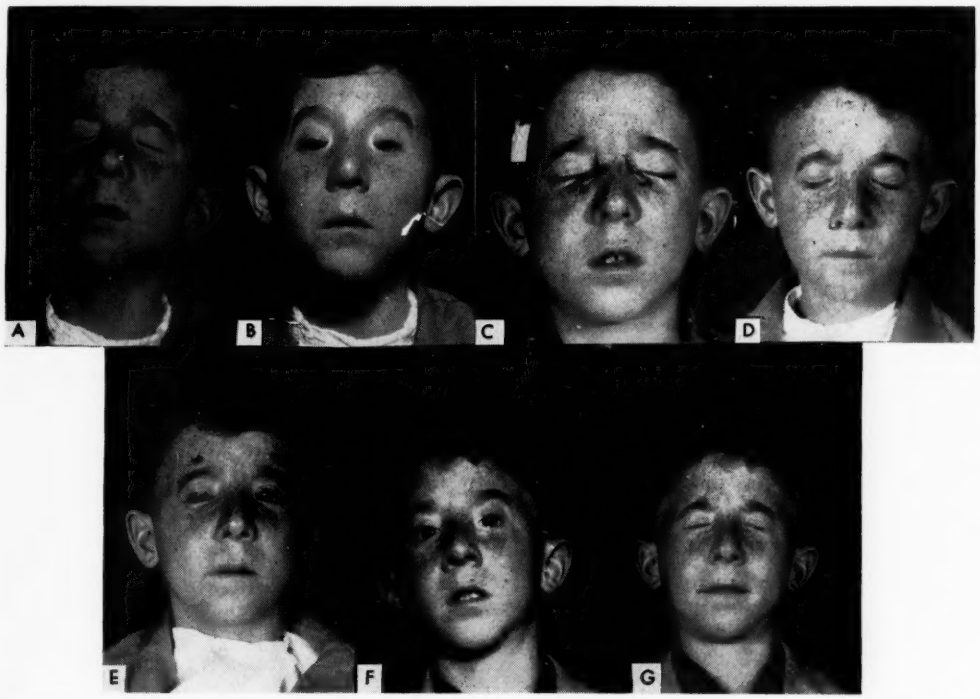

Fig. 3.—*A*, ptosis, congenital, with eyes closed. There was an effort to close eyes, because there was shortness in both upper and lower eyelid. *B*, note elevated eyebrows and tilted forehead. There is very marked epicanthus, making the eye slits smaller and further interfering with vision. *C*, Z plasties were done to reduce the epicanthus before correction of the ptosis. *D*, result of operation on epicanthi. Obstruction to vision is removed. *E*, one year after correction of epicanthus. Fascia was used to correct ptosis. Shortening of eyelids made elevation limited. *F*, one year after fascia transplant. Eyes open fairly well. Eyebrows are still elevated, owing to shortening in eyelids. *G*, lids are closed with effort. Result is fairly satisfactory. Later, skin grafts were used for all eyelids to produce normal appearance. Eye muscles functioned normally.

Fig. 4.—*A*, patient with eyes closed. Lid lag is so great that right eye could not be opened at all. Left eye could barely be opened. This condition arose during pregnancy five years earlier, during which patient had severe nausea and vomiting. Ptosis was progressive during pregnancy and for some months after, stationary for next two years. *B*, patient after fascia transplant. Because of marked redundancy in eyelids, section of skin was removed just before fascia was implanted. *C*, three years later, with eyes closed. *D*, note that eyelids expose almost entire pupil but eyes close without effort. No visible wrinkling of forehead when eyes are open.

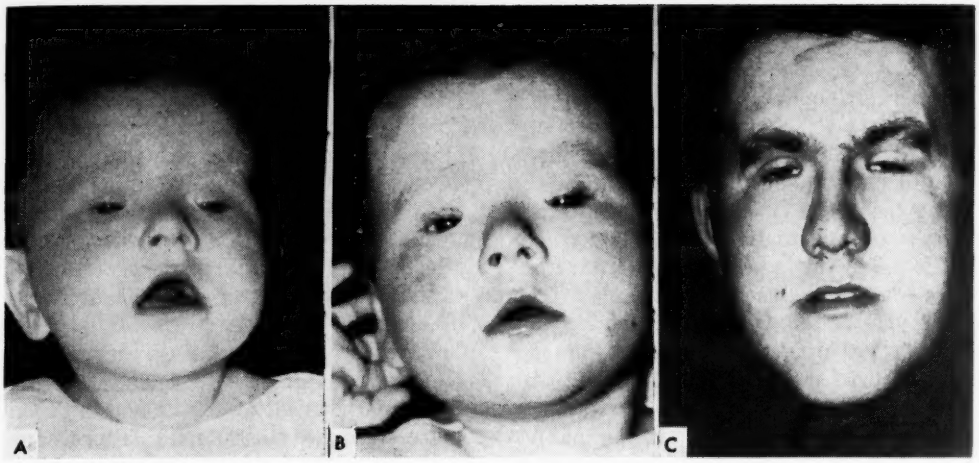

Fig. 5.—*A*, congenital ptosis, very marked, with some epicanthus. *B*, postoperative view, after fascial transplant. Epicanthus makes result look unsatisfactory; eyelids, however, open well. *C*, father of patient. Effort had been made elsewhere to correct ptosis by simply excising skin from eyelids. Note elevation of eyebrows in effort to obtain function.

begin to differentiate themselves from this epithelial lamina before the lids open. The lids begin to open in the sixth month, but usually it is well into the seventh month before this actually happens. The mesodermic tissue has developed beneath the ectoderm from which the muscles of the lids and eyes develop. The oculomotor nerve, which enervates the levator of the eyelid, arises from a group of neuroblasts in the medial part of the basal lamina of the midbrain. The peripheral fibers extend forward to end around the optic cup in the mesodermic tissue from which the eye muscles are derived. The nerve divides into two branches just before it enters the orbit. The inferior branch supplies the inferior oblique, the constrictor of the pupil and the ciliary muscle. The superior branch supplies the superior rectus, the inferior and medial rectus and the levator muscles of the upper lid.

The variety of congenital diseases of the oculomotor nerve suggests that there must be some influence that can act in degrees varying from the simple loss of function of the eyelids[1] to disturbances of motion of the eyes and pupils. The eyeballs rotate outwardly and cannot be moved inward, upward or downward. The pupils are dilated and do not react to light, directly or consensually, during accommodation. Light thrown into the affected

Fig. 6.—Preoperative view of patient. Effort had been made elsewhere to correct ptosis by excision of skin from eyelids. Excision was very radical, and patient could not close eyes. *B*, full thickness graft was inserted from neck, into eyelid. Postoperative result shown three weeks after operation. Adhesions are still present in eyelids. They are to remain for six months after operation to insure smooth healing without shrinkage. Subsequently, other eyelid will be corrected.

eye causes contraction of the opposite pupil. This would indicate that, whatever the cause, it can involve various portions of the nerves. One theory is that there is a mass contraction of all the muscles supplied by the third nerve, due to misdirection of regenerating nerve fibers.

Recent embryologic experimentation[2] seems to indicate the existence of a substance or substances called inductors. These act on the future neural plate from the layers of cells of the archenteric roof, which lies just under it. This influence can activate ectoderm to develop into the brain or any portion of the nervous system. This can explain why it may happen that varying amounts of the ectoderm may be activated by this influence to form portions of the third nerve.

Heredity may be a factor. In 3 cases in my series the condition has occurred in two generations. Two of the patients are male and 1 is female. In the latter case, father and daughter have marked ptosis. Much has been written about genetic, glandular and hereditary causes, but all this is very difficult to evaluate, as is true of most congenital anomalies. Muscular anomalies are not observed in cases of simple ptosis of the eyelids, even when there is some involvement of the ocular muscles. I have not encountered a case of absence or lack of levator muscle. It is really a neurologic failure.

The correction of the deformity resolves itself, therefore, into using muscles to replace the levators functionally and voluntary action of the patient to permit the eyelids to elevate when desired. Numerous operative procedures have been tried, which indicates that not all of the methods produced entirely satisfactory results. Smith[3] reported 57 different methods used for correction. The muscles that have been considered in correcting ptosis are the levator palpebrae superioris, the occipitofrontalis and the superior rectus. The levator splits off the superior rectus, so that the common innervation makes the use of the rectus questionable, since this muscle can be weak. Disturbing the muscles of the eye seems undesirable. Frequently there is a dimpling of the skin or a curtain effect, cosmetically most undesirable. Operations devised to shorten the lid by the removal of skin are entirely unsatisfactory. Those procedures which shorten the lid by partial excision of the tarsal plate or shifting of the levator muscle are also unsatisfactory.

The occipitofrontalis, in its normal function, is an accessory muscle of lid elevation. Utilization of the action of this muscle is the most desirable procedure for the correction of ptosis that is not complicated with disorders of the muscles of the eyeball. The procedure utilized is very satisfactory and offers permanent results.

Two spots are marked on the forehead, about midway between the eyebrows and the hair margin. The location of the spots is about the outer and inner ends of the eyebrow (Fig. 7*A*). Two spots are marked on the eyelid at the juncture of the middle third of the eyelid with the outer and inner thirds. These points are located in the fold in the eyelid just above the lid margin (Fig. 7*B*). These four points are punctured through the skin to permit the entrance of a needle threaded with a strip of fascia taken from the fascia lata of the patient. Fresh autogenous fascia is most desirable. Preserved fascia will stretch, and foreign bodies like silk may cause foreign body reaction. Two tension sutures are placed below the puncture wounds in the eyelid to aid in controlling the passage of the fascia. The fascia, threaded on a cutting needle, is passed through the cut in the forehead, going deep under the eyebrow and under the skin of the eyelid to emerge through the cut made in the eyelid (Fig. 7*C*).

The needle is then passed beneath the skin near the margin of the eyelid, to

emerge at the other incision (Fig. 8*A*). As the fascia is pulled through, a suture is passed under the fascia and through the skin to anchor the fascia at this point. This stitch closes the puncture incision in the skin.

The needle is then put through the same puncture wound to emerge in the forehead again, passing deeply beneath the eyebrow (Fig. 8*B*). When the fascia is pulled up, the incision is closed in the lid. The suture includes the fascia so that it will not pull up. The length of fascia in the lid is not under tension between the two openings. The needle is next passed through deep in the forehead to include the frontalis muscle, to emerge at the first opening (Fig. 8*C*). The fascia has been pulled up

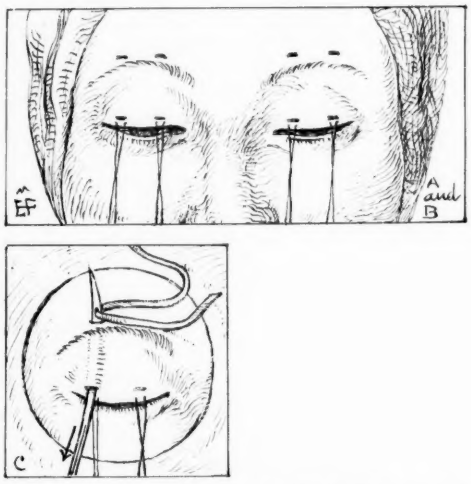

Fig. 7.—*A*, marks are made with brilliant green over the middle of the forehead and on the lids, over the wrinkle just above the margin of the eyelid. Each dot will be punctured with a knife, giving smallest possible openings for introduction of needle. Spots on eyelid are at juncture of middle third with inner and outer thirds. Marks on forehead are so placed as to form rectangle with marks on the eyelids. *B*, two traction sutures are placed just below marks on eyelid to aid in keeping lids taut when fascia is threaded through and to equalize tension when fascia is tied. *C*, needle threaded with strip of fascia is passed through puncture wound in forehead and passed deeply beneath eyebrow, passing out of puncture wound in eyelid. Passage of needle in lid must avoid entering mucosa of eyelid.

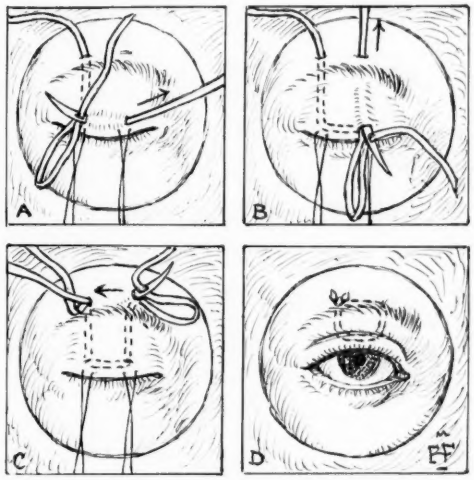

Fig. 8.—*A*, needle is passed beneath skin of eyelid to second puncture wound as fascia is pulled through. Lid is held so that suture can be passed between skin and mucous membrane. These points are in first normal fold of eyelid. *B*, needle is then passed into puncture wound and carried deeply under eyebrow, to emerge in puncture wound on forehead. *C*, second incision in eyelid is closed with suture beneath fascia, which is pulled up so that there is no puckering in eyelid. Needle in now inserted, to emerge at first opening. *D*, before fascia has been completely passed through to first incision it is pulled up to elevate lid and suture is passed beneath and through skin to hold tension. After needle emerges, first end is pulled up, elevating outer portion of eyelid. Ends of fascia are tied, and knot is held fixed with suture. Ends are passed beneath skin toward hairline and cut off as they emerge from skin. Last opening is now closed with suture.

to elevate the lid and is held by a suture (Fig. 8*D*). The ends of the fascia are tied after the first portion has been pulled up, elevating the lid to the desired level. The knot in the fascia is sutured with silk so that it will not slip. The ends are then passed beneath the skin and cut off where they emerge. These long ends help to maintain the tension of the fascia. The lids cannot be elevated too much, lest they should not close and cover the eyeball. They are elevated in such a manner that the margins are at the upper margins of the pupils. No dressings are applied. Ointment is put over the eyes to protect them. The eyes can be washed daily and more

ointment applied. The eyelids will not close over the eyes for a few weeks after the operation, so the eyes must be irrigated and cared for to prevent corneal ulcers. Tone develops in the lower lids, and the ultimate result becomes satisfactory.

The removal of fascia from the thigh does not interfere with the function of the leg after a few days. Sometimes an epicanthus or small eye slits may complicate the situation. Correction of the ptosis should be performed first and the other conditions treated as circumstances indicate. The correction of congenital ptosis should be delayed until the patient is at least 1 year old. This time lapse permits appraisal of the function of the eye muscles. Correction of ptosis subsequent to pregnancy or infection should be delayed for at least a year, to determine whether there will be recovery of function. Paralysis of the frontalis muscle precludes voluntary movement of the eyelid. The operation can be performed to improve the cosmetic appearance and to give the patient reasonable vision.

CONCLUSION

The embryologic and anatomic aspects of the eyelids are discussed in order to determine, if possible, the cause of the congenital type of ptosis. Various operative procedures involving shortening of the skin of the eyelids and/or utilization of the eye muscles are not satisfactory. The most satisfactory operative procedure, with the most lasting results, is the use of fascia taken from the patient and utilization of the frontalis muscle to operate the levator muscle of the eye. Rectangular treatment of the fascia transplant results in even elevation of the eyelid.

The operation offers the patient the best cosmetic result and improves vision. Surgical intervention should not be contemplated until it is reasonably sure that there will be no improvement in the acquired type of ptosis.

The congenital type should not be treated surgically until the patient is more than 1 year old and can control his voluntary movements.

The types of ptosis and the results that can be expected are illustrated by photographs. The author has performed this operation since the twenties. To the best of his knowledge, it was introduced by the late Dr. John Staige Davis.

CONCLUSIONI

Vengono discussi gli aspetti anatomici ed embriologici delle palpebre allo scopo di determinare, se possibile, la causa della ptosi congenita. I vari metodi chirurgici proposti fino ad ora (resezione della cute, utilizzazione dei muscoli oculari etc.) non sono soddisfacenti. Il sistema che ha dato i migliori risultati é quello che utilizza il muscolo frontale per sollevare il muscolo elevatore della palpebra: con un trapianto rettangolare di fascia si ottiene una elevazione simmetrica delle palpebre.

Con questo metodo si ottengono ottimi risultati estetici e si migliora la visione. L'intervento, naturalmente, non deve essere indicato fino a che non si sia sicuri che la ptosi non migliorerá in altro modo.

Vengono illustrati mediante fotografie i vari tipi di ptosi e i risultati che si ottengono. L'autore usa il metodo da lungo tempo; egli ritiene che sia stato introdotto dal Dr. John Staige Davis.

CONCLUSIONES

Se estudian en este trabajo los espectos embriológico y anatómico de los párpados para intentar determinar las causas de la ptosis congénita.

Los diversos procedimientos operatorios con acortamientos de piel de los párpados y, o, utilizando los músculos oculares no son satisfactorios. El método operatorio de mejor resultado y de resultados más duraderos consiste en el uso de una cinta

de fascia lata y uniendo con ella el músculo elevador al músculo frontal.

Esta operación ofrece al enfermo los mejores resultados cosméticos y además mejora la visión. La intervención quirúrgica no debe ser emprendida hasta no estar razonablemente seguros de que no hay posibilidad de curación expontánea.

Los tipos de ptosis y los resultados que pueden esperarse se exponen en diversas fotografías. El autor hace estas operaciones desde hace más de 30 años. Para mejor conocimiento de esta operación, fué difundida por el difunto Dr. John Staige Davis.

SCHLUSSFOLGERUNG

Die embryologischen und anatomischen Eigenheiten der Augenlider werden mit der Absicht, wenn möglich die Ursache der angeborenen Form der Ptose zu bestimmen, erörtert. Verschiedene chirurgische Verfahren mit Kürzung der Haut der Augenlider, mit Benützung der Augenmuskeln oder mit einer Kombination beider Eingriffe, sind nicht zufriedenstellend. Der befriedigendste operative Eingriff, der die meisten Dauererfolge bringt, besteht in der Verwendung der vom Kranken gewonnenen Faszie und in der Benützung des M.frontalis zur Operation des Hebemuskels des Auges. Rechtwinklige Anlegung des Faszientransplantats führt zu gleichmässiger Hebung des Augenlides.

Die Operation schafft beste kosmetische Resultate und verbessert die Sehfähigkeit des Kranken. Bei der erworbenen Form der Ptose sollte ein chirurgischer Eingriff nicht in Betracht gezogen werden, solange man nicht ziemlich sicher ist, dass keine Besserung mehr eintreten wird.

Die verschiedenen Formen der Ptose und die zu erwartenden Erfolge werden durch Photographien illustriert. Der Verfasser hat die Operation seit den zwanziger Jahren ausgeführt. Soweit ihm bekannt ist, wurde sie durch den verstorbenen Dr. John Staige Davis eingeführt.

CONCLUSIONS

L'auteur étudie les aspects embryologiques et anatomiques des paupières afin d'essayer de déterminer la cause de la ptose congénitale. Diverses techniques opératoires comprenant le recourcissement palpébral, l'utilisation des muscles oculaires, ne peuvent pas être considérées comme satisfaisantes, et c'est avec le fascia prélevé sur le patient, et le muscle frontal pour actionner le muscle releveur que l'on obtient les résultats les meilleurs et les plus durables. Le résultat cosmétique est également excellent, et la vision est améliorée. Mais l'intervention chirurgicale ne devrait être envisagée qu'après un délai raisonnable ayant permis de constater qu'une ptose acquise ne s'améliorera plus.

Les divers types de ptose et les résultats auxquels l'on peut s'attendre sont illustrés par des photographies. L'auteur rappelle l'opération dont le créateur paraît avoir été John Staige Davis, et qu'il pratique depuis plus de trente ans.

CONCLUSAO

Procura determinar a causa das ptoses congenitas pelos estudos embriologico e anatomico das palpebras. Diz que os metodos cirurgicos com redução de pele das palpebras utilisando ou não os musculos não são satisfatorios. Considera o uso da fascia lata inserida no musculo frontal elevado o elevador como o metodo mais satisfatorio. Diz que essa operação oferece ao doente os melhores resultados cosmeticos e melhora a visão. Não devem ser tentadas intervenções nos casos de ptose adquirida antes que hja segurança de ausência de regressão natural. Illustra os tipos e resultados obtidos por documentação fotografica. Refere que pratica essa operação há vinte anos e lembra o nome de seu creador Dr. John Staige Davis.

REFERENCES

1. Ford, F. R.: Diseases of the Nervous System in Childhood. Springfield, Ill.: Charles C Thomas, Publisher, 1952, 3d ed., p. 71.
2. Kiskadden, W. S., and others: Theories of the Etiology of Congenital Deformities, Surg., Gynec. and Obst. (Internat. Abstr. Surg.), 88:1, 1949.
3. Smith, F.: Plastic and Reconstructive Surgery. Philadelphia: The W. B. Saunders Co., 1951.

It was a boon for the medicine man to discover the medical virtues of plants and flowers, and he gradually sought a specific remedy for each illness. To extract poisons left in the flesh by the bite of a snake or a poisoned arrow, he used a hollow tube to suck out the dangerous fluid. His medicine was a mixture of magic, ritualistic mysticism, and a practical sense of curative measures. He stressed the overcoming of disease rather than the tending of the sick person.

It is possible that curare was also used as a therapeutic agent among these primitive Indians. With their empiric knowledge, the Indians of Patagonia and the Orinoco, and the Ticunas, who lived on the shores of the Marañón River, may have conceived the idea of utilizing curare in their medical concoctions. According to La Condamine, the Ticunas sprinkled salt and sugar on their wounds or took them orally as antidotes against curare. The *urari* of the Makushi, studied by Schomburgk in his travels, may have been used as a curative in cases of tetanus type convulsions. In the empiric mind of the medicine man, the gourds containing the dark sirup may have figured as a source of life as well as of death.

It is highly unlikely that once the aboriginal Indians discovered the deadly powers of curare they probed no further. We know that in the Upper Orinoco and in the vicinity of the Rio Negro the Indians swallowed curare, claiming to be immune to its toxic effects. This legend, now disproved, seems to point to the desire of the medicine man to try the curative powers of curare, since he was already acquainted with its lethal effects. Such experiments must have caused many deaths, but perhaps during these tests the primitive medicine man, bent over his vegetable alembic, watching the dripping of the deadly juice, may have perceived some of those very properties that the modern scientist has discovered in his laboratory.

Marti-Ibañez

Immediate Skin Grafting of the Saucerized Tibia in Chronic Osteomyelitis

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A method is presented which, it is hoped, will be used with meticulous attention to detail in order that it may not fall into disrepute.

Immediate skin grafts to the saucerized tibia for long-standing chronic osteomyelitis may help a patient who has been suffering for years because of chronic leg ulcerations.

The method, it is hoped, will supplant the now firmly entrenched method of saucerization, petrolatum gauze packing and endless waiting for granulation, with a later attempt at coverage.

CHRONIC osteomyelitis of the tibia with anterior long-standing leg ulcerations plagues the already strained bed capacity of many hospitals throughout the United States. Long-standing orthopedic teachings, which have now apparently become quite standardized, dictate excision of the ulceration, thorough saucerization of the bone, then petrolatum gauze packing of the wound and a policy of waiting until granulations fill in the area. Often the granulations never do completely fill in the wound, as with the long-standing open wound there are some areas of bone exposure that remain, with recurrent chronic ulceration.

Some orthopedic departments will wait until spontaneous healing with scar epithelization takes place; others will attempt to get clean granulation tissue covering and then apply a skin graft for coverage. This, in some instances, will be followed by flap or tube waltz procedures for more satisfactory coverage.

The method here proposed of split skin grafting of the saucerized tibia immediately, at the time of operation, has in my hands been highly successful in most cases—even more so since the advent of the electric dermatome, which takes a uniform thin graft that is easily handled.

It used to be said in some areas that a free skin graft cannot "take" directly on bone. This may be true of sclerosed cortical bone; it has been my experience, however, that the freshly and adequately saucerized tibia will take a skin graft. This means proper placement, so that the maximal amount of skin comes into contact with the cancellous bone and the healthy, well-beveled edge of the cortical areas.

Immediate skin graft replacement can often save a patient many months of hospitalization and may even mean the difference between the complete cure of a long-standing draining ulcer and a life practically devoted to dressing pads.

The method may easily fall into disrepute if all steps are not carried out to completion from every standpoint. Ade-

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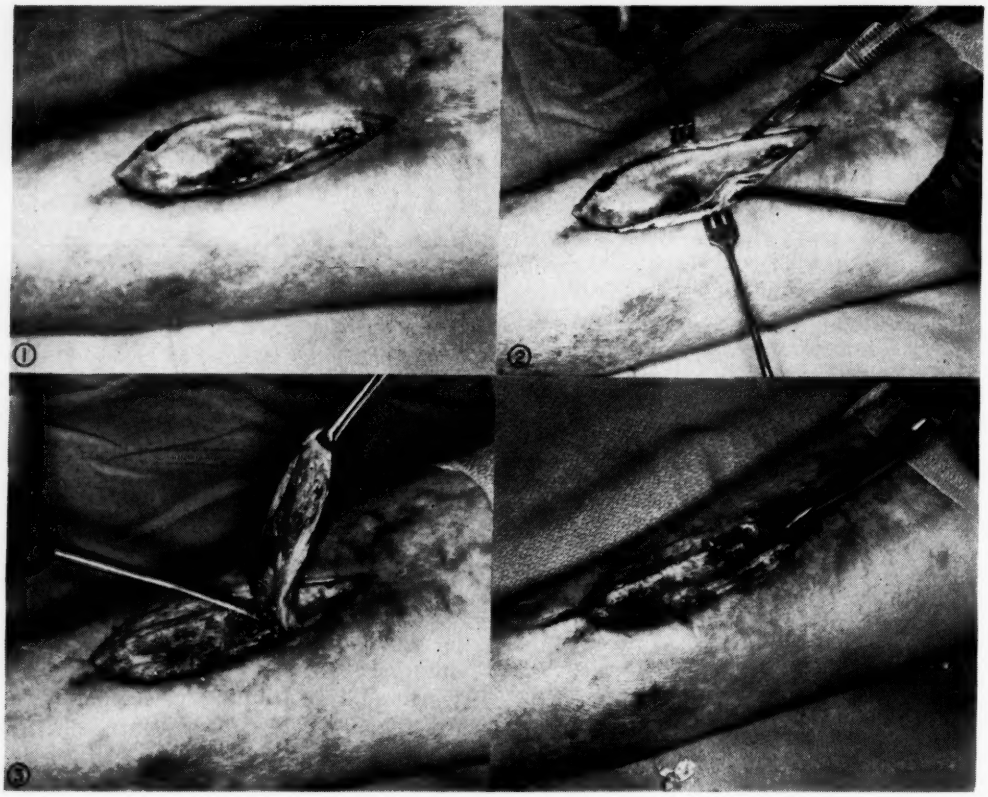
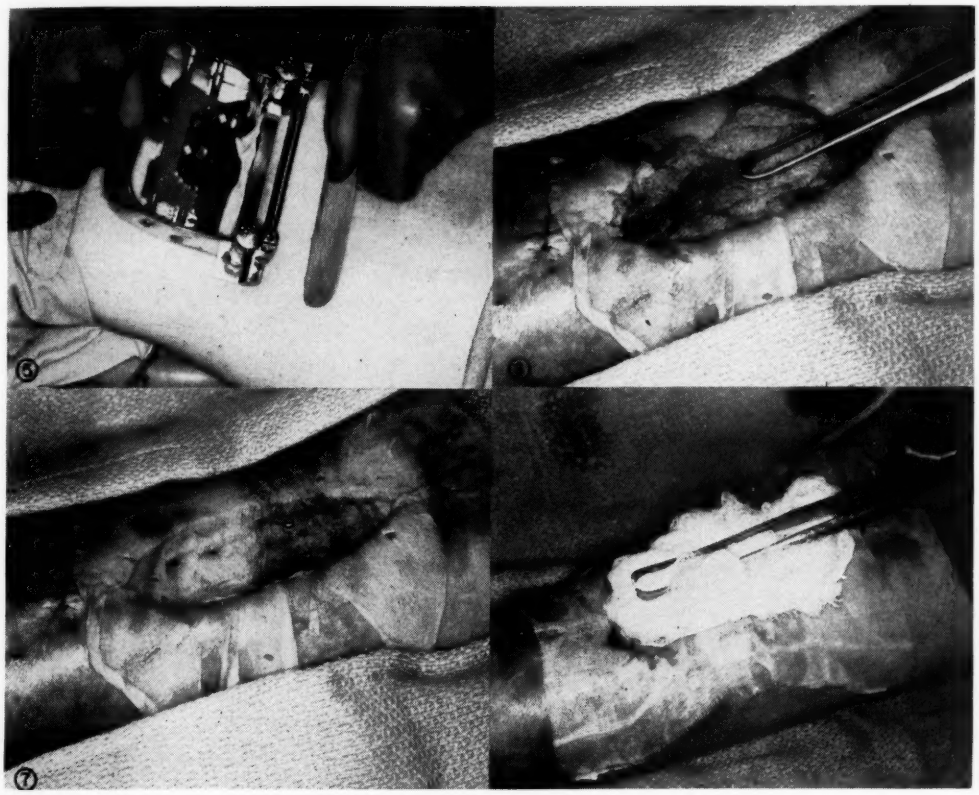
quate antibiotic control is necessary, depending upon the flora involved. Often it is necessary to wet-dress the wound several days before the operation and start general antibiotic care accordingly. General anesthesia and an adequate tourniquet are used.

The ulceration (Fig. 1) should be excised (Figs. 2 and 3) completely from the underlying bone. As much good skin coverage as possible should be left over the bone. It may be necessary to incise the skin above and below the bone area, which later can be sutured in order to gain better access to the contemplated area of saucerization. Adequate saucerization (Fig. 4) without overhanging edges should be done. The tourniquet can then be released and the bleeders at the edge of the skin tied off. A warm saline pressure pack is then placed into the saucerized wound during the time a 0.013-0.015 inch split thickness skin graft is being taken (Fig. 5) from the opposite thigh.

The pressure pack is then removed from the saucerized area. If by this time bleeding has been controlled, the adequate-sized "piecrusted" split thickness skin graft is stretched across the saucerized trough and gently placed (Fig. 6) so that it lies flush against bone in all areas (Fig. 7). One must work rapidly at this stage of the operation, so that no hematomas are left underlying the skin graft which, of course,



Figs. 1, 2, 3 and 4 (see text).



Figs. 5, 6, 7 and 8 (see text).

would spell disaster to the graft. If the cozing from the bone is slight, often the instillation of bovine thrombin into the wound immediately prior to the placing of the graft will help. A wet fluff is pressed over the skin graft to stretch it evenly and adequately into the saucerized area. This also helps to control bleeding. If the bleeding in the trough is excessive, tapping with a blunt instrument on the localized area will help close off these bleeders. Bone wax should not be used, as the split thickness skin graft will not "take" over the area so treated. If bleeding is too excessive to allow one to work safely with the skin graft, the tourniquet pressure should be replaced and the graft applied in the manner aforedescribed. Packing fluff into the trough (Fig. 8) should be more than adequate, and pads should be placed above this. Kling type pressure dressings are used, covered by elastic dressings, and plaster splinting for immobilization of the ankle area. The tourniquet is not removed until the pressure dressing is in place.

The initial dressing, unless high fever or marked infection with odor intervenes, is not done until the seventh or tenth day. The dressing must be done carefully at this stage, in order not to peel the skin off the bone. The wound is gently cleansed, hydrogen peroxide being used as a mechanical cleanser. Overlapping portions of skin graft can be excised to help cut down on drainage and possible infection at this

Fig. 9 (see text).

stage. If small hematomas are noted at this time, they should be gently expressed. A single-thickness petrolatum gauze dressing is then replaced over the graft and another pressure dressing applied. Adequate antibiotic control should be kept up throughout these procedures, depending upon the bacterial flora involved. Often local cleansing with neomycin solution in the depths of ulcer areas early in these procedures will be helpful.

The area is then redressed at adequate intervals. The patient is not allowed to be up, even if immediate good healing has taken place, until at least three to four weeks after the operation, in order to allow time for adequate circulatory support of the skin graft (Fig. 9). He should then be cautioned to use an elastic support of the lower extremity at all times when he is up and about and to be careful not to bump the involved area. In some of these cases this treatment is followed by tube pedicle or cross-leg flap procedures for more thoroughgoing coverage. In others, especially if the patient is elderly, I prefer leaving well enough alone.

Avoidance of Pitfalls.—I wish to reiterate that this method could easily fall into disrepute for a number of reasons. Meticulous attention, therefore, must be paid to the following factors:

1. Adequate antibiotic coverage.
2. Adequate excision of the ulcer without leaving a scar base on which to place the free skin graft (excision must be made straight down to the bone that is being saucerized).
3. Adequate saucerization, so that the free skin graft will touch only healthy, bleeding bone.
4. Adequate bleeding control, so that no

hematomas can be caught under the skin graft.

5. A thin split thickness skin graft adequately "piecrusted" (about 0.13-0.15 inch) in a large sheet, so that it can be stretched into the interstices of the saucerized trough. Sutures are not necessary, as the graft will overlap the wound edges and help hold the graft in proper position after it is packed into place.
6. Careful postoperative dressing, with adequate attention to frequent multiple dressings if necessary. After two or three weeks, occasional air-drying periods and local neomycin solution will help to accelerate healing.
7. Bed rest with the leg elevated, for at least three to four weeks after the operation. Ambulation should be gradual, with elastic support to the leg.

SCHLUSSFOLGERUNGEN

Der Verfasser berichtet über ein Behandlungsverfahren, von dem er hofft, dass es, um nicht in Misskredit zu geraten, mit peinlichster Beachtung aller Einzelheiten angewandt werden wird.

Die unverzügliche Anlegung einer Hautplastik auf einen flach freigelegten lange bestehenden chronischen osteomyelitischen Herd der Tibia kann einem Kranken, der jahrelang an chronischen Unterschenkelgeschwüren gelitten hat, von Nutzen sein.

Der Verfasser hofft, dass dieses Verfahren die zur Zeit fest eingewurzelte Behandlungsmethode ersetzen wird, die in flacher Freilegung des osteomyelitischen Herdes, Packungen mit Vaselingaze, endlosem Warten auf Granulation und späterem Versuch der Deckung des Defekts besteht.

CONCLUSIONS

L'auteur présente une nouvelle technique dont il espère qu'elle sera utilisée avec un grand soin dans les détails afin qu'elle ne tombe pas dans le discrédit.

Il s'agit de greffes cutanées au-dessus d'une dépression du tibia due à une ancienne ostéomyélite chronique, qui peuvent grandement soulager les malades ayant souffert pendant des années d'ulcérations chroniques des jambes.

Il est à souhaiter que cette méthode remplacera la technique actuelle réduite à ses derniers retranchements, avec pansements de vaseline et l'attente interminable de la granulation avec tentative ultérieure de revêtement.

CONCLUSOES

Apresenta um metodo que espera seja usado com cuidado para não cair no descredito. Enxertia de pele imediata nas curetagens da tibia para os processos cronicos de osteomielite com ulcerações antigas da perna.

Esse metodo poderá suplantar os sistemas antigos de tratamento alguns ainda em uso.

CONCLUSIONES

Se presenta un método esperando sea usado con meticulosa atención con el fin de que no vaya a caer en el descrédito. Se trata de injertos cutáneos sobre la tibia expuesta por osteomielitis crónica de larga duración con el fin de aliviar en el paciente que por muchos años ha sufrido de estas ulceraciones crónicas en la pierna. El método es de esperar ha de mejorar los métodos diversos que se vienen empleando en la actualidad.

The Proctologic Use of Topical Hydrocortisone

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PROCTITIS is a difficult problem therapeutically. With the advent of anti-inflammatory steroids, the systemic use of these agents has provided appreciable benefit. Clinical investigation of suppositories containing 10 mg. of hydrocortisone acetate for use in the treatment of patients who have various anal and rectal inflammatory lesions was conducted to determine the efficacy of their use in the practice of proctology.

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Rectal suppositories containing 10 mg. of hydrocortisone acetate were evaluated clinically in 76 cases of inflammatory conditions of the anorectum. Topical hydrocortisone proved to be free from corticosteroid side effects, and its use was beneficial to 96 per cent of the patients treated. Good results were obtained by 78 per cent and fair results by 18 per cent. Only 4 per cent of the patients failed to respond to therapy.

The local application of hydrocortisone in a suppository base is far more practical and convenient than is the rectal drip method of administration.

Local hydrocortisone acetate may be used with noteworthy safety and is a desirable addition to proctologic therapeutics.

The efficacy and safety of hydrocortisone used locally in the rectum have been fully established by a number of investigators,[1] and for this reason it was not deemed necessary to use a placebo to establish this further. An active adrenocortical hormone, hydrocortisone (Kendall's compound F), is the major corticosteriod in human plasma. It appears to act directly on the body tissues to reduce their responses to acute inflammation.

The efficacy of hydrocortisone administered rectally to patients who have chronic ulcerative colitis and irradiation proctitis is well established. When hydrocortisone acetate is instilled locally into the rectum in therapeutic dosage, the plasma level of Compound F and its urinary metabolites do not significantly increase.[2] Topical hydrocortisone, therefore, should permit more thoroughgoing treatment of patients who have proctitis and, in addition, permit the use of hydrocortisone in the treatment of patients for whom oral or parenteral steroid therapy is contraindicated. Antibiotics, used topically, may of themselves cause factitial proctitis, and, because they offer no benefit to many patients,[1d] it was considered best to use none unless specifically designated.

Method.—A formula* containing hydro-

*Wyanoids® HC, available from Wyeth Laboratories, Inc., Philadelphia.

cortisone acetate, 10 mg., and other soothing ingredients (extract of belladonna, 0.5 per cent; ephedrine sulfate, 0.1 per cent; zinc oxide; boric acid; bismuth oxyiodide; bismuth subcarbonate, and balsam peru in an oleaginous base) in a suppository base was used for the treatment of 76 patients who had various forms of proctitis and inflammatory reactions of the anoderm.

Of the 76 patients, 11 had pruritus ani (complicated by internal and external hemorrhoids in 1 and by mild proctitis in 1). Six had proctitis (2 general, 2 low grade, 1 in the lower portion of the rectum, 1 postoperative). Three had irradiation proctitis (complicated in 1 by a fissure and carcinoma of the rectum and pelvis, and in another carcinoma of the vagina). Nine had chronic ulcerative colitis (4 in Stage I, 2 in Stage II, 2 in Stage III and 1 with pseudopolyp formation). Forty-seven had postoperative inflammatory reactions (complicated by delayed healing, pain, pruritus, cryptitis or various inflammatory conditions).

It was recognized that the local use of this medication would be easier, attended by fewer side effects and more economical than the rectal drip method of administration.

One or two hydrocortisone suppositories daily were prescribed for varying periods of time to determine the usefulness of this form of therapy. The efficacy of topical hydrocortisone was designated as *good*, *fair*, or *none*, depending on the degree of improvement attained.

RESULTS AND COMMENT

The duration of therapy for the 76 patients ranged from twelve to sixty days. The average duration of therapy was twenty-six days (Table 1). Seventy-three patients improved after topical hydrocortisone therapy. Side effects from the hydrocortisone therapy did not occur in any of the patients.

TABLE 1.—*Duration of Therapy*

Diagnosis	*Number of Patients*	*Therapy Period (Days)*	*Average Duration (Days)*
Pruritus ani	11	14-48	29
Proctitis	6	12-48	28
Irradiation proctitis	3	12-60	28
Chronic ulcerative colitis	9	12-57	27
Postoperative inflammatory reactions	47	12-37	19
Total	76		
Average		12-48	26

TABLE 2.—*Results of Therapy*

		Results		
		Good	*Fair*	*None*
Diagnosis	*Number of Patients (Total)*	*Number of Patients*	*Number of Patients*	*Number of Patients*
Pruritus ani	11	6	3	2
Proctitis	6	6	0	0
Irradiation proctitis	3	1	1	1
Chronic ulcerative colitis	9	9	0	0
Postoperative inflammatory reactions	47	37	10	0
Total	76	59	14	3

Pruritus Ani.—The duration of therapy was from fourteen to forty-eight days for the 11 patients in this group. The average duration was twenty-nine days. The response to medication was *good* in 6 (55 per cent) and *fair* in 3 (27 per cent). Two patients (18 per cent) failed to respond to therapy.

Topical hydrocortisone was a helpful adjunct in the treatment of most of the patients who had pruritus. There were several cases in which the cause of pruritus probably was proctitis. In these instances it helped to ameliorate the pruri-

tus by relieving the primary cause. The topical hydrocortisone also was beneficial in the treatment of patients who had pruritus ani and proctitis as a result of candidiasis (moniliasis) which had developed after the use of oral antibiotics. The inflammatory response of tissues to Candida (Monilia) causes an exudate that irritates the perianal skin. Hydrocortisone reduced the inflammatory response and thereby lessened the irritation.

Benefits obtained in the treatment of patients who have pruritus ani probably have been the result of a reduction of inflammatory response in the lower portion of the rectum. The hydrocortisone suppositories decreased itching and soreness in the anal canal and alleviated the burning sensation and feeling of uneasiness. For the patient who had pruritus ani complicated by internal and external hemorrhoids, topical hydrocortisone helped to control itching and soreness in the anal canal. Injection treatments were adequate in controlling the hemorrhoids.

Proctitis.—The response of the 6 patients who had proctitis to the administration of topical hydrocortisone was excellent. One patient, who had low-grade proctitis, was greatly improved with the use of only twelve doses. The average duration of therapy for this group was twenty-eight days. The range was from twelve to forty-eight days. One patient, who had proctitis from postoperative scar tissue, improved rapidly after the institution of therapy. The inflammation was greatly reduced in another patient, who had proctitis as a result of eating spicy food.

Irradiation Proctitis.—Of the 3 patients in this group, the response to the administration of topical hydrocortisone was *good* in 1 and *fair* in 1. One patient did not respond. The duration of therapy was from twelve to sixty days and averaged twenty-eight days. It was observed that topical hydrocortisone markedly reduced bleeding, pain and discharge when the spread of malignant disease was not involved. Continuous treatment was necessary, and one or two doses daily, in the morning and at bedtime, were often sufficient. The patient who failed to respond to therapy had irradiation proctitis complicated by fissures, as well as carcinoma of the rectum and pelvis. At the time of examination of this patient the disease was terminal, and medication was ineffective. Bleeding was somewhat lessened for 1 patient who had irradiation proctitis complicated by carcinoma of the vagina, but the overall response was only fair.

According to Sherman[1a] topical application of hydrocortisone often produced improvement in early irradiation lesions but was less successful in the treatment of long-standing changes that involved the rectum. Local hydrocortisone given to a few Grade I and Grade II patients, who had experienced early changes without evidence of perforation or marked telangiectasis, produced excellent results.[1a]

Although the symptomatic effects may appear dramatic, local hydrocortisone may not always prevent the extension of irradiation proctitis, which has a chronic course. Often, however, it effectively controls acute episodes and the associated symptoms. This was the situation encountered with the remaining patient in this group. She had a good response to therapy over a sixty-day period, with marked lessening of pain, bleeding and redness. The disease finally became terminal, however, and the patient was not seen again for reappraisal.

Chronic Ulcerative Colitis.—The response to medication of all 9 patients in this group was good. The duration of therapy was from twelve to fifty-seven days. The average duration of therapy was twenty-seven days.

Four of the patients had chronic ulcera-

tive colitis in the first stage. One of the 4 patients had a flare-up in the lower 5 inches (10 cm.) of the rectum, but this subsided after treatment. In the second patient there was moderate activity in the lower portion of the rectum, which improved considerably after local hydrocortisone was used. In the third patient in this group there was a granular appearance above the anorectal line. The use of the suppositories completely controlled the symptoms. A marked improvement was noted in the fourth patient. There was a reduction in mucous discharge, disappearance of bleeding and rapid control of the flare-up.

There was marked improvement locally when medication was used, that is, lessened bleeding and mucous discharge, in 1 of the 2 patients who had chronic ulcerative colitis in the second stage. Within one month the other patient obtained pronounced improvement of ulcerations in the lower portion of the rectum.

For the 2 patients who had chronic ulcerative colitis in the third stage there was marked improvement, little to no bleeding, and a decreased discharge of mucus, and the symptoms were easily controlled.

The remaining patient in this group had chronic ulcerative colitis and nonspecific pseudopolyps. He obtained marked improvement. When medication was discontinued, the lower 2 inches (5 cm.) of the rectum again became irritated and therapy was reinstituted as required.

In many cases of low grade chronic ulcerative colitis extensive involvement does not occur, and occasional subacute exacerbations of the disease are easily treated medically. The patients remain ambulatory. More frequently, these patients have involvement in the rectum and possibly the lower portion of the sigmoid. There may be symptoms, such as rectal bleeding, involuntary passage of mucus, occasional passage of a few semiformed stools, and tenesmus. The use of one or two doses of the medicament daily frequently controls such subacute phases and dramatically minimizes the symptoms.

Topical hydrocortisone is considered of little value, however, when the transverse and ascending portions of the colon are involved. It has not been the policy to rely on this therapy in the severe culminating stages of the disease.

Local hydrocortisone has been advocated for chronic ulcerative colitis by Truelove[1c] and Watkinson,[1d] who have reported studies in which double blind technics and sequential analysis were used. Both investigators showed by sigmoidoscopic and histopathologic studies that improvement in the mucosa occurred after local use of hydrocortisone, and both have noted the advantages of topical medication containing 10 mg. of hydrocortisone. The results in this study confirm those obtained by these clinicians.

Postoperative Inflammatory Reactions.—One of the most useful effects of topical hydrocortisone was achieved in those patients who had appreciable scar tissue formation at the anorectal line, with consequent painful defecation after anorectal surgical procedures. In patients in whom a smooth funnel-shaped anal canal develops after the surgical procedure, with or without anal stenosis, there usually is some area that does not heal completely. This condition is chronic and difficult to ameliorate. Frequently the unhealed areas may require secondary anoplastic procedures.

The use of topical hydrocortisone for twelve to thirty-seven days gave almost immediate relief, with good or fair improvement in the tissue in all 47 cases. This was the largest group of patients studied. In 37 patients (79 per cent), the results were *good.* In 10 (21 per cent) the results were *fair.* In all instances the

scar tissue was softened, pain was relieved and other related symptoms were ameliorated. In 3 cases in which there was an unhealed area, the results were *good* in 1 and *fair* in 2. In the 2 cases in which the results were only fair there was relief of pain and other symptoms, but the area did not heal.

It is to be emphasized that, in order to be helpful, treatment must be instituted as soon as possible after the development of postoperative scar tissue with inflammatory reaction. Except for its possible palliative effect, it is my opinion that topical hydrocortisone would be of little value in cases of chronic disease in which extensive scar tissue formation has become established.

SCHLUSSFOLGERUNGEN

Die Anwendung rektaler Suppositorien, die 10 mg. Hydrokortisonazetat enthielten, wurde klinisch an 76 Fällen mit entzündlichen Erkrankungen des Mastdarms und des Afters ausprobiert. Es zeigte sich, dass die örtliche Anwendung von Hydrokortison zu keinerlei kortikosteroiden Nebenerscheinungen führte und sich bei 96 Prozent der behandelten Patienten als nützlich erwies. Die Erfolge waren gut in 78 Prozent und leidlich in 18 Prozent. Nur in vier Prozent der Fälle versagte die Behandlung.

Die örtliche Hydrokortisonverabfolgung in Form von Zäpfchen ist viel praktischer und bequemer als die Behandlung mit Tropfeinläufen.

Die örtliche Anwendung des Hydrokortisonazetats ist von bemerkenswerter Unschädlichkeit und stellt einen wünschenswerten Zusatz im therapeutischen Rüstzeug des Proktologen dar.

CONCLUSIONES

En 76 casos de condiciones inflamatorias anorrectales se ha estudiado clínicamente la acción de supositorios con 10 mg. de acetato de hidrocortisona. Se ha demostrado que la hidrocortisona tópicamente está libre de los efectos secundarios del corticosteroide y su uso ha sido benéfico en el 96% de los enfermos tratados; de éstos, 78% fueron resultados excelentes y 18% de simple mejora.

Es mucho más práctica la aplicación local de hidrocortisona en supositorios que la administración rectal gota a gota. El uso local de la hidrocortisona puede ser sorprendentemente seguro, y una adición excelente a la terapia proctologica.

CONCLUSIONS

Une étude clinique quant aux résultats de l'application de suppositoires rectaux contenant 10 mg d'acétate d'hydrocortisone a été faite dans une série de 76 cas. En application locale l'hydrocortisone s'est révélée exempte d'effets secondaires corticostéroïdes et s'est montrée utile chez 96% des malades traités. De bons résultats ont été obtenus dans 78% des cas, des résultats satisfaisants dans 18%; seuls 4% des cas n'ont pas réagi à ce mode de traitement.

Cette thérapeutique (hydrocortisone locale sous forme de suppositoires) est plus pratique et plus agréable pour le malade que l'administration par goutte-à-goutte rectal.

L'acétate d'hydrocortisone locale peut être utilisée avec une sécurité remarquable et c'est une adjonction souhaitable aux thérapeutiques touchant à la région recto-colique.

CONCLUSOES

Avalia os resultados obtidos com os supositorios á base de lomgrs. de hidrocortisona em 76 casos de molestias ano-retais. A substancia em uso local mostrou ser desprovida de efeitos corticoesteroides colaterais em 96% dos casos tratados. Obteve bons resultados em 78% e satisfatorios em 18%. Somente 4% não tiverem

resultado. A aplicação em supositorio é mais pratica e conveniente que o metodo gota á gota. O acetato pode ser usado com segurança e representa um meio terapeutico muito bom na protologia.

REFERENCES

1. (a) Sherman, L. F.: A Reevaluation of the Factitial Proctitis Problem, Am. J. Surg. 88:773-779 (Nov.) 1954. (b) Hurtig, A.: Local Hydrocortisone Acetate for Radiation Proctitis, Postgrad. Med. 15:37-39 (Jan.) 1954. (c) Truelove, S. C.: Treatment of Ulcerative Colitis with Local Hydrocortisone Hemisuccinate Sodium: A Report on a Controlled Therapeutic Trial, Brit. M. J. 2:1072-1077 (Nov.) 1958. (d) Watkinson, G.: Treatment of Ulcerative Colitis with Topical Hydrocortisone Hemisuccinate Sodium: A Controlled Trial Employing Restricted Sequential Analysis, Brit. M. J. 2:1077-1082 (Nov.) 1957.

2. Nabarro, J. D. N.; Moxham, A.; Walker, G., and Slater, J. D. H.: Rectal Hydrocortisone, Brit. M. J. 2:272-274 (Aug.) 1957. Patterson, M.: Studies on the Absorption of Hydrocortisone from the Colon of Patients with Idiopathic Ulcerative Colitis, Texas Reports on Biol. & Med. 16:508-514 (1958). Schwartz, R. D.; Cohn, G. L.; Bondy, P. K.; Selesnick, S.; Brodoff, M., and Spiro, H. M.: Absorption of Hydrocortisone from the Rectum in Chronic Ulcerative Colitis, Clin. Research 6:36 (Jan.) 1958.

Man has done nothing more than imitate scientifically the mechanism of natural defense used by animals. Lecomte de Nouy (quoted by Jentzer) said: "The criterion of adaptation is usefulness, while the criterion of evolution is freedom." The error of early research and conclusions was to mistake evolutional features for vital phenomena. Instead of exalting means of defense—which often accelerate exhaustion of cells and precipitate death—the new artificial hibernation deprives us temporarily of our freedom through a neurovegetative block of harmful reactions, and gives the hibernating organism a period of repose and sleep during which to recover and save its life.

Laborit and his collaborators have led us into a vast mansion of mysterious shadows—artificial hibernation—and have opened some of its treasure rooms that they may be explored by investigators the world over. We stand on the threshold of a new era of research into vegetative and endocrine phenomena, perhaps also into new psychiatric methods, with the consequent widening of our knowledge of biology and human pathology. Artificial hibernation does not correct Claude Bernard. It broadens the horizon he described and provides a new theory and promising tools for the research biologist, so that he may constantly progress toward that ideal of happiness—unattainable in medicine—enjoyed by the man who knows the cause of things. For, as Vergil said, *Felix qui potuit rerum cognoscere causas.*

Marti-Ibañez

Selection of Operative Procedures for Ulcerative Colitis and Familial Polyposis

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THE symptoms and disability associated with colitis are due to the toxic effect of the retained diseased bowel. Most colonic surgeons are convinced that all of the diseased bowel must be removed before the patient is restored to normal health. After operation the vast majority of these patients return to a normal life in their families, their occupations and social activities. There is a striking difference in the appearance of the patient who has had the diseased bowel removed and that of the one who still has a large area of infected bowel continuing to exert its debilitating effect.

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The results of the surgical management of colitis have greatly improved over the past fifteen years, and far more patients are being referred for earlier surgical intervention. The Brooke ileostomy and the fitting of the bag at the end of the operation have almost eliminated the complications of ileostomy. The great majority of patients are completely rehabilitated and are able to return to a relatively normal life in their families, occupations and society.

The most important indications for operation and the procedures generally used are discussed.

The morbidity and mortality rates of intestinal surgery have been greatly reduced with a better understanding of bowel preparation with neomycin and the sulfonamides and tetracycline drugs, estimations of blood volume, control of fluid and electrolyte balance, correction of nutritional deficiencies, improved anesthesia and the free use of whole blood. These improvements have almost entirely eliminated the multiple-stage procedures in surgical treatment of the colon.

The improved construction of the ileostomy as first carried out by Brooke[1] has eliminated the debilitating effects of the old conventional ileostomy, including nutritional, fluid and electrolyte problems. Well-fitting plastic or rubberized bags are placed around the ileostomy immediately after the operation. This has made the patient much more comfortable and his condition compatible with most social and occupational requirements.

As a result of these important factors there has evolved a much more understanding attitude on the part of the gastroenterologist and the internist. In recent years they are referring an increased number of their patients with colitis for early operation. This should further lower the mortality rates.

In about 75 to 80 per cent of cases, chronic ulcerative colitis undergoes remission in the hands of the gastroenterologist with the proper use of steroids (androgens and estrogens), whole blood, chloromycetin, sulfonamides and adequate general common sense management. Diet does not play an important part, except

for the few patients who are allergic to milk or other proteins. About 25 to 30 per cent of the patients with the chronic condition will require surgical intervention. The incidence of carcinoma in association with chronic ulcerative colitis has been variously reported as ranging from 2.5 to 11 per cent. Probably the average is 4 to 5 per cent. There is a higher incidence of carcinoma in the cases of long standing colitis—say those with a duration of ten years or more.

The development of surgical therapy for ulcerative colitis really began about 1875, when Wilks and Moxon[2] called attention to colitis as distinguished from other diseases characterized by chronic diarrhea. Mayo Robson,[3] in 1893, reported doing inguinal colostomy, with local treatment of the ulcerated surfaces. Ileostomy, cecostomy and appendicostomy were subsequently used in the same way for irrigation of the diseased colon with various medications.

By 1913 John Young Brown[4] and others were suggesting terminal ileostomy as a means of putting the inflamed colon at rest. As recently as ten years ago, ileostomy alone was performed fairly often as a palliative or life-saving procedure and often as a preliminary to total colectomy for colitis. A few good surgeons still maintain that it should be done for the very ill patients.

In the early 1940's it became apparent that many chronically ill patients with disability, anemia, arthritis, etc., could not hope to be restored to a relatively normal life until the entire diseased portion of the bowel had been removed, for it was realized that the symptons were due to the retention of the diseased bowel. At that time total colectomy and abdominoperineal resection were done in three or four stages.

By 1949 the aggressive surgical management of colitis had progressed to the point at which many surgeons were doing ileostomy and subtotal colectomy, followed by abdominoperineal resection of the rectum in three to six months, while others were performing ileostomy and complete coloproctectomy in one stage. Some were advising emergency resection of the entire colon for acutely ill patients. Someone has said, and I most heartily agree, that many of these patients with acute fulminating disease are "too sick *not* to be operated upon."

Ileoanal anastomosis has been done in cases of colitis, multiple (familial) polyposis and megacolon, but this procedure has been discontinued because of its technical difficulties and its many complications. Ileoproctostomy has been done in recent years for polyposis and colitis, and it is now recommended occasionally in cases of colitis when there is little, if any, involvement of the rectum. In my experience such cases are extremely rare, and I do not personally anastomose to a diseased rectum.

Vagotomy has been used for ulcerative colitis, with various results. In perhaps one-half of the patients there is some temporary relief from frequent watery bowel movements. Occasionally there is dramatic cessation of diarrhea. Vagotomy does not affect the basic pathologic process, and I have discontinued its use.

A note at this point on sexual function is apposite. Whenever the rectum is removed for colitis it is extremely important to preserve the entire sphincter mechanism, with minimal injury to the nervi erigentes, so that normal sexual powers may be retained. This conservative removal of the rectum hastens wound healing.

In the majority of instances of colitis the morbidity rate is lower with the one-stage procedure. I have some reason for pause, however, in this respect. Several years ago, at Presbyterian Hospital, 2 patients about 30 years of age died rather suddenly, of what suggested a cardiac condition, about one week after ileostomy and one-stage coloproctectomy. Autopsy

failed to reveal the cause of death in either case. Since that time I have done ileostomy and subtotal colectomy, followed in three to six months by an abdominoperineal resection.

Few surgeons have had sufficient personal experience in operating for ulcerative colitis to express positive opinions with respect to the procedures that should be used. It is helpful, however, to consider the opinions of some of the men who have had more than average experience with this disease. Some of the opinions are here presented, in various categories.

Acute Fulminating Colitis With or Without Perforation, Which Has Not Responded to One to Two Weeks of Medical Management. — Bacon[5] prefers a one-stage ileostomy and coloproctectomy; Cattell[6] does a preliminary ileostomy and defers colectomy; Dixon[7] establishes a double barrel ileostomy with the region under local anesthesia; Garlock[8] prefers ileostomy alone, or ileostomy and, in some selected cases, subtotal colectomy, with some increased risk. Mayo[9] states: "Unless there was some good reason opposed to surgical treatment, I would perform abdominal colectomy and remove the rectum from above, at least to the levator muscles, close the pelvic peritoneum and drain through the anus with a sump suction drain." Ochsner[10] does ileostomy and colectomy. He would not continue on medical management for more than one week. Ravitch[11] performs one-stage pancolectomy and abdominal ileostomy; Ripstein,[12] ileostomy with subtotal colectomy to the level of the rectosigmoid. In his opinion, if there is perforation in the rectosigmoid, total colectomy may be necessary. The rectal stump is transected and buried beneath the peritoneum. When the rectum is the site of perforation or severe hemorrhage, abdominoperineal resection is indicated in addition to ileostomy and colectomy; Thompson and Cave[13] do total coloproctectomy in one stage with the patient under hypothermia. My own experience has caused me to perform ileostomy and subtotal colectomy and to defer the abdominoperineal resection.

Ileoproctostomy For Chronic Ulcerative Colitis With Diffuse Involvement of the Rectum.—In October 1939, Garlock,[14] reporting to the New York Surgical Society, suggested that "it might become possible in the occasional case to take down the ileostomy and connect it with the rectal segment."

Aylett[15] reported, in 1956, 100 cases of diffuse ulcerative colitis in which he removed the entire colon, following this by an ileorectal anastomosis with a temporary ileostomy above. On the basis of his clinical experience, he contended that the rectal ampulla shows minimal involvement in the majority of patients, while the rectosigmoid and sigmoid present greater ulceration and deformity owing to the separate nerve supply of the rectum. He reasoned further that the increased inflammation in the rectum is due to the "dripping down" of infected material from the ulcerated area above.

This is in direct contrast to everything that has been taught and accepted by the authorities on ulcerative colitis. Most experienced men are convinced that the disease begins in the rectum and ascends into the colon. In patients with early involvement, when the disease has not progressed to the cicatrizing stage, it has been my experience in the vast majority of cases that the rectum is more involved than the colon above. Bacon and Vaughn observed that the disease begins in the rectum in more than 90 per cent of cases.

Aylett[15] stated further that in the series he reported the diseased rectal segment healed after the ileorectal anastomosis and that further studies by serial biopsies showed surface healing of the mucosa. He granted, however, that the submucosal strutures cannot be expected to return to normal if they have been scarred by the

disease process. This, of course, indicates that the bowel does not return to normal. He reported no recurrence of the proctitis.

Turnbull[16] reported on 14 patients on whom he has performed subtotal colectomy and ileostomy, followed in a year or more by an ileorectal anastomosis. He did no decompressive ileostomy at the time of the anastomosis. He stated further that the primary disability observed after ileoproctostomy consists of multiple daily bowel movements, which decrease in the first few weeks. Six of his 14 patients take antidiarrheal medication. Rectal disease, present at the time of anastomosis, healed in all but 3 of the 14 patients. In 4 of these cases the results were considered clinical failures. In 2 patients the rectal disease has failed to heal, and these patients are in moderately poor health because of frequent small bowel movements.

Bacon[5] is utterly opposed to ileoproctostomy in the presence of disease of the rectum. The rectum should never be preserved if it is or has been involved in any way. I have just torn down my fourth ileorectal anastomosis, even though the rectum appeared normal.

Cattell[6] does not favor anastomosis to a rectum that is diseased.

Mayo[9] reported on 30 patients on whom ileoproctostomy was performed. Sixteen underwent one-stage subtotal colectomy and ileoproctostomy, 11, two-stage procedures, consisting of ileoproctostomy followed later by subtotal colectomy, and 3 underwent multiple stage procedures, eventually undergoing ileoproctostomy. Seventeen of the 30 specimens showed involvement of the terminal ileum with chronic ulcerative colitis. He was able to follow up 22 of these patients. He concluded that there are instances, although rare, in which abdominal colectomy with ileoproctostomy is a justifiable procedure in cases of ulcerative colitis. Further, it is assumed, of course, that the operation is not performed in cases in which the disease has affected the rectum more than minimally. He prefers end-to-end ileoproctostomy over end-to-side anastomosis.

Ochsner[10] considers ileoproctostomy "useful in a small number of selected patients."

Ravitch[11] employs ileoproctostomy only in presence of little or no rectal disease.

Ripstein[12] stated: "Our results have not been too good. Seven operations with ultimate breakdown and ileostomy in four. In one case ileostomy was refused, although she now has a rectovaginal fistula. All in all 5 failures, 2 successes."

Thompson and Cave[13] stated that "all of our experiences with ileosigmoidostomy in ulcerative colitis indicate that it is not a good operation due to the danger of ascending ileitis and flare-up of disease in the sigmoid and rectum."

Many other surgeons have reported their experiences with ileoproctostomy for colitis, but space does not permit reference to their results. The opinions cited in the foregoing paragraphs are considered representative of surgical thinking at present.

Ileoproctostomy for colitis is obviously an experimental approach to a difficult disease, in an effort to maintain intestinal continuity. One must maintain an open mind. When a sufficient number of these operations has been done and enough time has elapsed, it will be possible to determine whether or not intestinal continuity can be maintained in the presence of active diffuse ulceration in the rectal ampulla. I venture to hazard the opinion that ileoproctostomy for colitis with diffuse proctitis will be largely discontinued, in the same way that ileoanal anastomosis has been discarded by most surgeons. Possibly there may be a few highly selected patients in whose cases the rectum is minimally involved and this procedure might be used. This is based upon the conviction that the disease ascends from the rectum and that the rectal condition is not

secondary to a "dripping down" from the rectosigmoid area.

Indications and Procedures in the Surgical Treatment of Ulcerative Colitis.—The urgent indications for immediate operation are as follows:

1. Repeated massive uncontrollable hemorrhage, which may occur in the acute and chronic phases: It is my practice to perform ileostomy and subtotal colectomy except when the hemorrhage can be demonstrated as arising from the rectum, in which circumstances a total coloproctectomy with ileostomy in one stage is preferred.

2. Actual or impending perforation, with peritonitis: Impending perforation should be suspected if there is increasing abdominal distention associated with localized direct and rebound tenderness, especially if there is radiologic evidence of dilatation of the entire colon or a portion of it, in the absence of distention of the small bowel. One must be constantly on the alert for this complication if the patient has been given prolonged steroid therapy, which may mask the perforation. Ileostomy with subtotal colectomy is the operation of choice. It is my preference to defer abdominoperineal resection.

3. Acute fulminating (toxic) colitis which has not responded to conservative management in one to two weeks: This is a medical and often a surgical emergency. Fulminating colitis occurs in 2 to 3 per cent of the cases of ulcerative colitis. This incidence is slightly lower than that of carcinoma in association with colitis. Perforation may occur early in this disease and may go unrecognized if the symptoms are masked by steroid therapy. Ileostomy and subtotal colectomy should be done promptly, so as to remove most of the acutely infected bowel. It is my opinion that an unjustified risk is assumed by adding an abdominoperineal resection of the rectum when the patient is acutely ill. I do not advocate ileostomy alone in the emergency treatment of any of these patients. Severe toxemia, perforation, peritonitis and hemorrhage may take place even with an ileostomy alone.

Other important indications for surgical intervention are:

1. Chronic irreversible disease that has not undergone remission in two or three years of conservative treatment, with disability of the patient. The procedure usually employed under these conditions is ileostomy and coloproctectomy in one stage, although my preference is to defer abdominoperineal resection of the rectum for three to six months. In the highly selected case, with minimal or no involvement of the rectum (which in my experience is very rare) it may be possible to do an ileoproctostomy, preferably with a complementary ileostomy above.

2. Associated carcinoma or widespread polyposis: The association of carcimona with colitis is well known, particularly when the colitis is of long standing, say ten years or more. It is probable that the incidence of carcinoma with colitis is between 4 and 5 per cent. It has been variously reported at 2.5 to 11 per cent. This indicates an ileostomy and coloproctectomy in one stage.

3. Abscesses, intraperitoneal, resulting from perforation of the diseased colon: When these are incised, the result is fecal fistulas. These abscesses, however, should be drained, and a complementary ileostomy or colostomy is sometimes done. Resection of the bowel, including the fistula, should be carried out later, with the appropriate accompanying surgical measures —usually ileostomy and coloproctectomy.

4. Rectovaginal fistula: This results from perforation of the vaginal wall by an abscess in the septum. In no circumstances should the fistulas *per se* be excised. This would simply increase the size of the fistula. It should be included in the coloproctectomy.

5. Perianal and perirectal fistulas:

These, if extensive, contraindicate any attempt to preserve the rectum. They will not heal permanently. Attempt to remove them increases the inflammatory involvement and will further destroy the sphincters, with resultant anal incontinence. They may be removed locally if the proctitis can be cleared up, but no fistula should be operated upon in the presence of ulcerative disease or acute inflammation of the rectum. If there is no hope of clearing up the colitis, ileostomy and coloproctectomy are indicated.

It is to be hoped that the gastroenterologist and the internist will, through research and experimentation, find a cure for this disease that will make all of these operations unnecessary. Since colitis can be controlled in many instances with the steroids (estrogens and androgens) or cortisone in combination with various other medications, it may be that an explanation of the onset and control of the disease will be found in the steroids and other elements of the glands of internal secretion. Sooner or later, in my own opinion, medicaments will be found that will control or even cure ulcerative colitis, with an effect similar in many respects to that of the anticholinergics on duodenal ulcer.

Ileoanal Anastomosis for Colitis, Megacolon or Familial Polyposis.—Bacon[5]: "I have had no experience with anal anastomosis."

Cattell[6]: "We do no ileoanal anastomosis."

Dixon[7]: "Those cases I have are no good, that is, they're back to diaper stage."

Garlock[8]: "I have not been too happy with this operation because of the lack of control and the technical difficulties."

Mayo[9]: "My experience with ileoanal anastomosis for colitis, megacolon or familial polyposis has been confined mostly to taking down this operation that another surgeon has performed and establishing an ileostomy. I could not recommend ileoanal anastomosis with a clear conscience."

Ochsner[10]: "Ileoanal anastomosis is an unsatisfactory procedure."

Ravitch[11]: "Anal ileostomy continues to prove entirely satisfactory for polyposis. It can be made to work and has given a few excellent long-term results in ulcerative colitis, but the yield is probably inadequate to justify the operation." This opinion is based upon 9 cases of one-stage pancolectomy with anal ileostomy in cases of polypoid adenomatosis and 4 cases of anal ileostomy after one-stage pancolectomy for ulcerative colitis.

Ripstein[12]: "The results have been good in megacolon and polyposis, and I think this is a very satisfactory procedure. In ulcerative colitis I have reservations because the inflammatory disease so often involves the rectum and perirectal tissues."

Thompson and Cave[13]: "We would prefer to leave in the rectum for familial polyposis. We think it is a poor operation for ulcerative colitis. We do not think it is necessary for the treatment of megacolon."

My own experience with ileoanal anastomosis has been extremely bad, and I have discontinued its use because of the technical difficulties, loss of anal control and other complications.

Hiatt[17] has been good enough to permit me to include 4 of his cases in which coloproctectomy with ileoanal anastomosis was done at Presbyterian Hospital in 3 cases for megacolon and in 1 for ulcerative colitis.

Megacolon: 1. M. F., 16 years old, ten-year follow-up; three to five bowel movements a day; no disability. 2. J. R., five-year follow-up; three to five bowel movements a day; nutritional anemia. 3. Mrs. M., five-year follow-up; two to four bowel movements a day; seepage at night, for which she has to wear a pad.

Ulcerative Colitis: I. Z., eight-year follow-up. "This is the only really unsatisfactory case which I have had, in that he has nine to fifteen stools a day and leaks copiously at night. We are contemplating an abdominal ileostomy.

"I have had 4 cases of coloproctectomy with

ileoanal anastomosis done at Presbyterian Hospital, 2 for multiple (familial) polyposis and 2 for ulcerative colitis. Because of complications, all of these had to be taken down and a permanent abdominal ileostomy established."

Multiple (Familial) Polyposis: 1. C. K., aged 23 years, presented multiple polyps involving the entire colon and rectum. After the coloproctectomy and ileoanal anastomosis, a peri-ileal pelvic abscess developed and was drained. Because of constant leakage a chronic granulomatous process developed in the entire perianal area. This proved to be incompatible with normal existence. Two years after the anal ileostomy was done it was taken down and an abdominal ileostomy was established, with Noble plication of the lowermost two-fifths of the small bowel because of dense adhesions. Numerous complications followed the original operation. Since the abdominal ileostomy was done almost eight years ago, the patient has been well and working, and has produced at least one child.

2. M. L., aged 30 years, had multiple polyps involving the entire colon and rectum. After the coloproctectomy and ileoanal anastomosis, large peri-ileal and perianal abscesses and fistulas developed, with marked excoriation of the perianal skin and induration of the buttocks bilaterally. Because of the persistent fistulas and constant drainage with severe excoriation, an abdominal ileostomy was done almost nine years ago. Some polyps of the terminal ileum developed, for which operation has been recommended. The patient is in good general health and prefers to wait.

Ulcerative Colitis: 1. E. S., 43 years old, had advanced ulcerative colitis with marked fibrosis of the entire colon and rectum. She had undergone some operations for *fistulae in ano* previously. These compromised the sphincter mechanism, although at the time of colectomy and ileoanal anastomosis the sphincters seemed to be functioning well. After the ileoanal anastomosis, anal stenosis and loss of sphincter control developed. This resulted in marked perianal excoriation. The anal ileostomy was taken down more than eight years ago, with excision of the distal three feet of the terminal portion of the ileum because of dense adhesions in the pelvis and bilateral salpingo-oophorectomy for cystic disease. Subsequently excision of an anopelvic sinus tract and, later, repair of an incisional hernia became necessary. The patient is now well.

2. P. H., aged 29 years, had undergone a double-barreled ileostomy elsewhere. This was closed, and a total colectomy with ileoanal anastomosis was done. The patient "felt fine, off and on," for about four years while she was taking codeine and probanthine. She had several movements during the day and had to get up three or four times a night. She failed to gain weight and finally decided that she would be better off with an abdominal ileostomy. This patient has been in good health since the abdominal ileostomy was established five and one-half years ago.

Because of these 4 experiences I believe there is no place for ileoanal anastomosis in the treatment of ulcerative colitis and multiple polyposis. Hiatt[17] agrees that it is not a good operation for colitis. My experiences, however, are too limited to permit any definitive answer.

Familial Polyposis of the Colon and Rectum.—This is a hereditary disease, transmitted according to mendelian laws. Dukes[19] stated that "those who inherit it will transmit it to one-half of their children eventually" and that "there are rarely any symptoms of intestinal disease until the second decade of life." In a group of 38 patients he noted that the average age at onset of symptoms was 21 years. There are no symptoms until the polyps have developed. These polyps may be discovered by sigmoidoscopic examination before there has been any clinical manifestation.

Mayo, DeWeerd and Jackson[18] noted that in some cases symptoms did not appear until perhaps ten years after the initial appearance of the polyps. They stated: "The malignant potentialities of each individual polyp, when multiplied by the myriads of polyps present, make this disease the most dangerous precursor of malignancy known. It is no exaggeration to say that every person with untreated, diffuse polyposis of the colon will die of carcinoma of the colon before he reaches the age of 50 years or will have advanced malignant disease of the colon when he reaches the age of 50 years."

Dukes[19], from the standpoint of carcinoma control, divided familial polyps into three stages. The first stage may last throughout childhood, but there are no symptoms, and sigmoidoscopic examination will not reveal any abnormality. In the second stage the polyps are developing but have not caused any symptoms. Sigmoidoscopic study will reveal the polyps. In the third stage, signs and symptoms of the disease are present. Close observation is important, because surgical treatment will soon be necessary.

Heretofore it has been the consensus that polyps will develop into carcinoma, and it is generally agreed that there is a a close association between polypoid and carcinomatous disease. Recently, however, several authors have expressed some doubt. Dukes[19] stated: "Not only does cancer very frequently follow clinical polyps but it is also very insidious in its onset, not at first giving rise to any characteristic or distinctive symptoms."

Dukes[19] agreed fully with Neel, Bolt and Pollard,[20] who stated: "Any person with polyps above the age of 25 is clearly within the danger zone." He also agrees with Dockerty,[21] who said: "About 50 per cent of the patients who have familial polyposis are likely to harbor infiltrating colon carcinoma by the time they have reached the age of 30."

The first clear description of true familial polyposis (adenomatosis) was presented by Luschka in 1861, according to Mayo and Wakefield.[22]

In 1901 H. Lilienthal[32] made the first bold surgical approach to polyposis when he did an ileosigmoidostomy, followed later by resection of the colon down to the area of anastomosis. Fulguration of the polyps of the rectum was not done. Nineteen years later the patient was reported alive and well. In 1918 Lockhart-Mummery[24] successfully did the same procedure with fulguration of the polyps in the rectal segment. In 1926 Coffey[25] reported doing an ileostomy in 1922, followed in 1924 by removal of the colon and rectum in stages. In 1930 Rankin[26] preferred permanent ileostomy with total coloproctectomy, while in 1937 he advocated ileosigmoidostomy with retention of the rectum. Boehme[27] stated that the first one-stage total colectomy with preservation of the rectum seems to have been done by Hickman[28] in 1932, although it was not reported until 1944. Boehme[27] reported 7 cases in which end-to-end anastomosis of the ileum to the rectosigmoid was done after preliminary fulguration of the polyps in the rectum and rectosigmoid. No patient in this series had more than 3 stools in twenty-four hours.

Bacon[29] has expressed preference for ileostomy and coloproctectomy because of the high incidence of carcinoma. This is based upon a report of 59 patients, 71.7 per cent of whom showed initial carcinoma. Secondary carcinoma developed in retained segments of bowel in 4 of a possible 16 instances (25 per cent). In the "benign group" of 13 patients with adenomatosis, carcinoma developed in the retained segment of a possible 7, or 71.4 per cent.

Cattell[9] performs subtotal colectomy with ileoproctostomy, with fulguration of the rectal polyps.

Dixon[17] does subtotal colectomy and anastomoses the ileum to the rectosigmoid, later fulgurating the polyps.

Garlock[8] stated that if the rectum is not too extensively invaded he does a subtotal colectomy with a temporary ileostomy and exteriorization of the sigmoid. The polyps are fulgurated through the anus and the sigmoid opening. When all of the polyps are removed (in three to six months) the ileostomy is taken down and reconnected to the sigmoid by an end-to-end anastomosis. When the rectum is hopelessly involved by myriads of polyps that cannot be removed by fulguration, total coloproctectomy is done, with a permanent ileos-

tomy. In some cases it may be possible to ream out the mucosa and submucosa of the rectum so as to permit an ileoanal anastomosis. "I have not been too happy with this operation," he has said, "both from the standpoint of the lack of control and the technical difficulties."

Mayo[9] fulgurates the polyps of the rectum prior to colectomy and end-to-end ileoproctostomy. Proctoscopic examinations are repeated every six months, with fulguration of any polyps that make their appearance. Abdominoperineal resection is done if carcinoma is present.

Ochsner[10] stated that he does a "colectomy and anastomosis of the ileum to the rectum in intelligent patients who will return every three months for proctoscopy. In those who will not return, colectomy and abdominoperineal."

Ravitch[11] performs one-stage pancolectomy and anal ileostomy.

Ripstein[12] does total colectomy with ileoanal anastomosis or permanent abdominal ileostomy.

Thompson and Cave[13] prefer total colectomy with ileoproctostomy or ileosigmoidostomy. Sigmoidoscopic study is done at regular six-month intervals with fulguration of any recurrent or persistent lesions.

Because in most cases myriads of polyps are present, it is my practice to do ileostomy and coloproctectomy.

It is generally agreed that familial polyposis may be handled surgically by (1) permanent ileostomy and total coloproctectomy or (2) subtotal colectomy and ileoproctostomy in the absence of carcinoma of the rectum, with fulguration of the polyps in the retained rectal segment. Most authors prefer the latter procedure, although a few advocate coloproctectomy with ileoanal anastomosis.

Close observation must be maintained throughout life, so that any polyps that persist or develop in the future may be destroyed promptly. This may prevent carcinoma from developing in the remaining segment. Hubbard[30] recorded a case of multiple polyposis in which the polyps disappeared spontaneously from the rectal segment after colectomy. Duke[19] has also observed this at St. Mark's. He stated: "If surgical treatment is necessary and is carried out at an early stage, it generally will be possible to avoid permanent colostomy or ileostomy."

CONCLUSIONS

The results of the surgical management of colitis have greatly improved over the past fifteen years, and far more patients are being referred for earlier surgical intervention. The Brooke ileostomy and the fitting of the bag at the end of the operation have almost eliminated the complications of ileostomy. The great majority of patients are completely rehabilitated and are able to return to a relatively normal life in their families, occupations and society.

The most important indications for operation and the procedures generally used are as follows:

1. Acute fulminating toxic colitis, including that associated with actual or impending perforation with peritonitis, is a medical emergency and requires prompt surgical attention if conservative treatment is not effective within one week. It is the author's practice to do an ileostomy and subtotal colectomy to remove most of the diseased bowel. Abdominoperineal resection is deferred. A few authorities do an ileostomy alone; others do total coloproctectomy with a permanent ileostomy.

2. Massive uncontrollable hemorrhage requires ileostomy and subtotal colectomy except when the hemorrhage can be demonstrated to have arisen in the rectum, in which circumstances ileostomy and proctectomy are indicated.

3. Chronic irreversible colitis with disability of the patient, intractable to medical treatment, indicates, in the majority of instances, permanent ileostomy and

coloproctectomy. A number of reports, however, indicate that there are rare cases in which the colon is only minimally involved, in which an ileoproctostomy may be performed with good results. Much more time and experience will be necessary to determine whether this procedure can be used in a significant number of cases.

4. Rectovaginal fistula *per se* should not be operated upon in the presence of ulcerative colitis. This usually requires ileostomy and coloproctectomy.

5. Perianal and perirectal fistula should not be removed in the presence of ulcerative colitis. If a remission of the colitis cannot be induced, these fistulas should be included in the definitive coloproctectomy.

With regard to ileoanal anastomosis, 3 cases of ulcerative colitis and 2 of familial polyposis are presented in which the results of anal ileostomy were completely unsatisfactory. A permanent abdominal ileostomy had to be done in 4 and is contemplated in the fifth. Most authorities do not consider this a good operation, although a few state that it can be used satisfactorily for megacolon and polyposis.

Multiple polyposis (familial) is generally managed by ileoproctostomy and fulguration of the polyps in the remaining rectal segment either before, during or after the subtotal colectomy. Because of the high incidence of carcinoma in these polyps, the high rate of complications, and the impossibility of adequate follow-up in many cases, some surgeons prefer permanent ileostomy and coloproctectomy.

CONCLUSIONS

Les quinze dernière années ont montré une nette amélioration des résultats du traitement chirurgical de la colite et un nombre de malades beaucoup plus élevé est adressé au chirurgien pour une intervention plus précoce. L'iléostomie de *Brooke* et l'adaptation du sac à la fin de l'opération ont presque complètement éliminé les complications de cette intervention. La grande majorité des malades sont tout à fait rétablis et aptes à mener une vie familiale, professionnelle et sociale à peu près normale.

Voici les indications opératoires les plus importantes avec les thérapeutiques plus généralement utilisées.

1. La colite toxique aiguë foudroyante, ainsi que celle associée à une perforation effective ou imminente avec péritonite, est bien entendu un cas d'urgence médicale; il faut intervenir chirurgicalement sans retard lorsque le traitement conservateur reste négatif pendant une semaine. L'auteur pratique en général une iléostomie et une colectomie subtotale en vue d'une résection maximum des tissus atteints. La résection abdominopérinéale est différée. Un nombre restreint d'autorités en la matiere pratiquent une iléostomie seule; d'autres font une coloproctectomie totale avec iléostomie permanente.

2. L'hémorragie massive incontrôlable nécessite une iléostomie et une colectomie subtotale sauf quand il peut être établi que l'hémorragie a son point de départ dans le rectum, auquel cas une iléostomie et une proctectomie sont indiquées.

3. La colite chronique irréversible rebelle au traitement médical et s'accompagnant d'une invalidité, appelle dans la plupart des cas une iléostomie et une col proctectomie permanentes. Cependant il ressort d'un certain nombre de rapports qu'il est de rares cas dans lesquels le colon n'est impliqué dans le processus pathologique qu'à un degré minime; une iléoproctostomie peut donner de bons résultats dans ces cas. Il faudra encore beaucoup de temps et d'expérience afin de déterminer la possibilité d'étendre l'application de cette méthode.

4. La fistule rectovaginale *per se* ne devrait pas être opérée en présence d'une colite ulcéreuse. Cet état nécessite en général une iléostomie et coloproctectomie.

5. Les fistules périanales et périrectales ne devraient pas être excisées lors de colite ulcéreuse. Si l'on ne peut obtenir une rémission de la colite, ces fistules sont à inclure dans la coloproctectomie définitive.

En ce qui concerne l'anastomose iléoanale, trois cas de colite ulcéreuse et deux cas de polypose familiale sont décrits, dans lesquels l'iléostomie anale a abouti à un échec complet. Il a fallu pratiquer une iléostomie abdominale permanente dans quatre cas, et cette intervention est actuellement aussi envisagée pour le cinquième cas. La plupart des autorités en la matière ne considèrent pas cette intervention comme satisfaisante, alors que quelques-uns estiment qu'elle peut donner de bons résultats dans les cas mégacolon et de polypose.

La polypose multiple du type familial est généralement traitée par iléoproctostomie et fulguration des polypes du fragment rectal restant, cela avant, pendant ou après colectomie subtotale. Du fait de l'incidence élevée de carcinomes dans ces polypes, des nombreuses complications et de l'impossibilité où l'on est souvent de suivre ces cas, quelques chirurgiens préfèrent pratiquer une iléostomie et coloproctectomie permanentes.

SCHLUSSFOLGERUNGEN

Die Ergebnisse chirurgischer Behandlung der Dickdarmentzündung haben sich in den letzten fünfzehn Jahren erheblich gebessert, und es werden jetzt sehr viel mehr Kranke zum frühen chirurgischen Eingriff überwiesen. Die Ileostomie nach Brooke und das Anpassen des Beutels bei Beendigung der Operation haben Komplikationen der Ileostomie fast ausgeschaltet. Die grosse Mehrzahl der Kranken werden völlig wiederhergestellt und können zu einem verhältnismässig normalen Leben in der Familie, im Beruf und in der Gesellschaft zurückkehren.

Die wichtigsten Indikationen zum chirurgischen Eingriff und zu den allgemein angewandten Verfahren sind die folgenden:

1. Die akute plötzlich ausbrechende toxische Dickdarmentzündung einschliesslich der Fälle mit erfolgter oder drohender Perforation und Bauchfellentzündung stellt einen medizinischen Notfall dar und erfordert, wenn konservative Behandlung innerhalb einer Woche unwirksam bleibt, sofortige chirurgische Behandlung. Der Verfasser führt im allgemeinen eine Ileostomie und eine subtotale Kolonresektion aus, um den grössten Teil des erkrankten Darmes zu entfernen. Die abdominoperineale Resektion wird aufgeschoben. Einige wenige Autoritäten nehmen nur eine Ileostomie vor, andere entschliessen sich zu einer Totalresektion des Dickdarms und des Mastdarms mit endgültiger Ileostomie.

2. Schwere nicht stillbare Blutungen erfordern Ileostomie und subtotale Dickdarmresektion, ausser wenn der Ursprung der Blutung im Mastdarm nachgewiesen werden kann; in solchem Falle sind Ileostomie und Mastdarmresektion angezeigt.

3. Die chronische irreversible Dickdarmentzündung bei körperlich schwer behinderten Kranken, die auf medizinische Behandlung nicht ansprechen, erfordert in der Mehrzahl der Fälle Ausführung einer bestehenbleibenden Ileostomie und Resektion des Dickdarms und Mastdarms. Es gibt allerdings eine Reihe von Berichten, die auf das Vorkommen seltener Fälle hinweisen, bei denen der Dickdarm nur in geringem Masse geschädigt ist; hier lässt sich eine Ileoproctostomie mit gutem Erfolg ausführen. Es bedarf jedoch noch geraumer Zeit und grösserer Erfahrung um festzustellen, ob sich dieses letztere Verfahren in einer wesentlichen Anzahl von Fällen anwenden lässt.

4. Eine Mastdarmscheidenfistel *an sich* sollte bei Bestehen einer geschwürigen Dickdarmentzündung nicht operiert werden. Dies erfordert gewöhnlich Ileostomie

und Resektion des Dickdarms und Mastdarms.

5. Perianale und perirektale Fisteln sollten bei Bestehen einer geschwürigen Dickdarmentzündung nicht reseziert werden. Wenn sich eine Remission der Dickdarmentzündung nicht erzielen lässt, sollte die Entfernung der Fisteln in die endgültige Resektion des Dickdarms und Mastdarms eingeschlossen werden.

Was die Anastomosierung des Ileums mit dem After betrifft, so wird über drei Fälle von geschwüriger Dickdarmentzündung und zwei von familiär auftretender Polypose berichtet, bei denen die Ergebnisse dieser Operation völlig unbefriedigend waren. In vier Fällen musste eine abdominelle Dauerileostomie angelegt werden, und im fünften Falle wird dieser Eingriff in Erwägung gezogen. Die meisten Autoritäten halten diese Operation nicht für gut, wenn auch einige behaupten, dass sie sich bei Megakolon und bei Polypose mit befriedigendem Erfolg anwenden lässt.

Die (familiär auftretende) Polypose wird im allgemeinen mit Ileoproctostomie und mit Fulguration der im Mastdarm zurückbleibenden Polypen vor, während oder nach subtotaler Dickdarmresektion behandelt. Wegen der Häufigkeit von Krebs bei diesen Polypen und von Komplikationen und wegen der Unmöglichkeit, viele dieser Fälle in angemessener Weise nachzuuntersuchen, bevorzugen manche Chirurgen die bestehenbleibende Ileostomie und Resektion des Dickdarms und Mastdarms.

CONCLUSIONI

I risultati della cura chirurgica della colite sono molto migliorati in questi ultimi 15 anni e un maggior numero di pazienti vengono affidati al chirurgo. La ileostomia di Brooke e l'applicazione della borsa alla fine dell'intervento hanno quasi eliminato le complicanze dell'ileostomia. La maggior parte dei malati viene completamente riabilitata e puo' ritornare ad una vita quasi normale nel seno della famiglia e della societa'.

Le indicazioni principali e le tecniche di solito usate sono le seguenti: 1) La colite acuta fulminante tossica, compresa quella associata a perforazione o con perforazione minacciante e peritonite, e' una condizione che richiede la pronta attenzione del chirurgo se la cura conservativa non ottiene effetti decisivi entro una settimana. L'autore e' solito praticare una ileostomia e una colectomia subtotale asportando quasi tutto il colon malato. La resezione abdominoperineale viene rimandata ad un secondo tempo. Alcuni chirurghi praticano la sola ileostomia, altri fanno una proctocolectomia totale con ileostomia definitiva.

2) La emorragia massiva non controllabile richiede l'ileostomia e la colectomia subtotale tranne quando si sia dimostrato che l'emporragia procede dal retto; in questo caso e' indicata la proctectomia e l'ileostomia.

3) La colite irreversibile cronica con inabilita' del paziente e inefficacia della cura medica indica nella maggior parte dei casi la proctocolectomia e la ileostomia permanente. In molti casi, tuttavia, risulta che il colon e' interessato solo in minima parte, sicche' puo' riuscire utile una ileoproctostomia. E' necessario tempo ed esperienza prima di poter dire se questo metodo potra[1] usarsi in un certo numero di casi.

4) La fistola rettovaginale, di per se stessa, non deve essere operata in presenza di una colite ulcerosa. Questa di solito richiede l'ileostomia e la proctocolectomia.

5) Le fistole perianali eperirettali, del pari, non devono essere asportate in caso di colite ulcerosa. Se non si riesce ad ottenere una remissione della malattia, le fistole debbono essere incluse nella proctocolectomia.

Per quanto si riferisce alla anastomosi ileoanale, vengono presentati tre casi di

colite ulcerosa e due di poliposi famigliare in cui i risultati dell'anastomosi ileoanale furono del tutto insoddisfacenti. In 4 di essi si dovette fare un'ileostomia addominale e nel quinto si dovra' farla. Molti chirurghi non considerano buono questo intervento, mentre altri lo ritengono utilenel megacolon e nella poliposi.

La poliposi multipla famigliare di solito viene trattata con la ileoproctostomia e la folgorazione dei polipi nel segme to rettale residuo, sia prima che durante o dopo la colectomia. Tuttavia, data l'elevata frequenza del cancro in questi polipi, le numerose complicazioni e la impossibilita' di seguire attentamente i malati, alcuni chirurghi preferiscono la proctocolectomia e la ileostomia definitiva.

CONCLUSOES

Os resultados do tratamento da colite tem sido melhor nos passados quinze anos porque um numero maior de doentes tem malsido levado á cirurgia.

A ileostomia de Brooke quasi eliminou as complicações. A grande maioria está completamente reabilitada e apta a retornar a uma vida normal.

As indicações mais importantes para a operação e os metodos mais usados são os seguintes:

1. A colite toxica fulminante incluindo as que se associam com perfuração e peritonite são uma emergencia medica e requerem pronta atenção cirurgica se o tratamento conservador não for eficiente dentro de uma semana. O A. costuma praticar uma ileostomia com colectomia subtotal para extirpar a maior parte do intestino enfermo. A resecção abdomino-perineal é postergada.

2. A hemorragia massiça, incontrolavel, requer ileostomia e colectomia subtotal exceto quando a hemorragia pode ser demonstrada com sede no reto, quando então deve ser feita ileostomia e excisão retal.

3. A colite cronica irreversivel com incapacidade do doente, resistente ao tratamento medico indica na maioria dos casos uma ileostomia permanente e retocolectomia. Raros casos são citados em que o colo está ligeiramente comprometido e então uma i eo-retectomia pode dar bons resultados.

4. A fistula reto-vaginal per se não deve ser operada na presença de colite ulcerativa. Usualmente requer ileostomia e colporetectomia.

5. A fistulas perianis e periretais não devem ser operadas quando houver colite ulcerativa. Se não houver remissão elas dever ser incluidas no segmento da colectomia.

Com respeito a anastomose ileoanal o A. apresenta 3 casos de colite ulcerativa e 2 de polipose familiar nos quais uma operação desse tipo foi completamente satisfatorio. Muitas autoridades não consideram essa operação muito boa embora possam recomenda-la para o megacolo e a polipose.

A polipose familiar multipla é geralmente tratada por ileoretectomia e fulguração dos polipos remanescentes, antes durante ou depoisda colectomia subtotal. Pela altamente grave incidencia do carcinoma nesses polipos, elevada taxa de complicações e a impossibilidade de seguimento nesses casos alguns cirurgiões preferem a ileostomia permanente com retocolectomia.

CONCLUSIONES

Los resultados del tratamiento quirúrgico de la colitis han mejorado considerablement en los últimos quince años, y con ello mayor número de enfermos acuden para un tratamiento precoz. La ileostomía a lo Brooke con adaptación de una bolsa al final de la intervención han eliminado casi por completo las complicaciones de la ileostomía. La mayor parte de los enformos se recuperan completamente y quedan aptos para reintegrarse a

una vida normal con la familia, las ocupaciones y la sociedad.

Las indicaciones más importantes de la operación y los procedimientos generalmente empleados son los siguientes:

1. La colitis tóxica fulminante aguda, incluyendo los casos con perforación y peritonitis en una urgencia médica que requiere una intervención quirúrgica rápida si el tratamiento conservados no es efical dentro de la semana. El autor practica una ileostomía plus colectomía subtotal para eliminar lo más posible del intestino enfermo. No practica de momento la resección abdominoperineal. Algunos autores practican únicamente una ileostomía; otros hacen una coloproctectomía con una ileostomía permanente.

2. La hemorragia masiva incontrolable requiere ileostomía y colectomía subtotal excepto cuando puede ser demostrado que la hemorragia procede del recto en cuyo cao se practican ileostomía y proctectomía.

3. La colitis crónica irreversible con grafe afectación del estado general y rebelde al tratamiento médico indica en la mayoría de los casos ileostomía permanente con coloprotectomía. Sin embargo ciertos número de referencias indican que en algunos casos el cólon está sólo afectado mínimamente y entonces puede ser suficiente con la práctica de una ileoproctostomía. Se necesita aún más tiempo y experiencia para determinar si tal proceder puede aplicarse en un número significativo de casos.

4. La fisura recto-vaginal per se no debe ser operada en presencia de una colitis ulcerosa. Corrientemente tal caso requiere ileostomía y coloprotectomía.

El autor presenta 3 casos de colitis ulcuosa y dos de poliposis familiar en los cuales la anastomosis ileoanal fué seguida de fracaso. En cuatro de etos casos ha sido preciso establecer una ileostomía abdominal permanente y habrá que hacerla también en el quinto. Muchos autores no encuentran satisfactoria la anastomosis íleoanal, aunque la reconocen aceptable para casos de megacolon o poliposis.

La poliposis múltiple familiar es tratada generalmente por eleoproctostomía con fulguración de los pólipos en el segmento rectal redundante antes, al tiempo o después de la colectomía subtotal. A causa de la frecuencia del carcinoma en esto pólipos, la abundancia de complicaciones y la imposibilidad de un tratamiento ulterior en muchos casos algunos cirujanos prefieren una ileostomía permanente y una idoprotectomía.

REFERENCES

1. Brooke, B. N.: Management of Patient with Colostomy or Ileostomy, Postgrad. M. J. **30**:237-241, 1954.
2. Wilks, S., and Moxon, W.: Lectures on Pathological Anatomy. London: J. and A. Churchill, 1875.
3. Robson, J.: Case of Colitis with Ulceration Treated by Inguinal Colostomy and Local Treatment of Ulcerated Surfaces; Subsequent Closure of the Artificial Anus, Tr. Clin. Soc. London **26**:213-215, 1893.
4. Brown, J. Y.: The Value of Complete Physiological Resection of the Large Bowel in the Treatment of Certain Ulcerative and Obstructive Lesions of this Organ, with Description of Operative Technique and Report of Cases, Surg., Gynec. & Obst. **16**:610-613, 1913.
5. Bacon, H. E.: Personal communication to author, June 1959.
6. Cattell, R. B.: Personal communication to author, June 1959.
7. Dixon, C. F.: Personal communication to author, June 1959.
8. Garlock, J. H.: Personal communication to author, June 1959.
9. Mayo, C. W.: Personal communication to author, July 1959.
10. Ochsner, A.: Personal communication to the author, June 1959.
11. Ravitch, M. M.: Personal communication to the author, June 1959.
12. Ripstein, C. B.: Personal communication to the author, June 1959.
13. Thompson, J. E., and Cave, H.: Personal communication to the author, June 1959.
14. Garlock, J. H.: The Surgical Treatment of Ulcerative Colitis, Dis. of Colon & Rectum, to be published.
15. Aylett, S.: Total Colectomy and Ileorectal Anastomosis in Diffuse Ulcerative Colitis, Brit. M. J. **1**:489-492, 1957.
16. Turnbull, R. B. Jr.: Surgical Management of Ulcerative Colitis, J.A.M.A. **169**:1025-1027, 1959.
17. Hiatt, R. B.: Personal communication to author, April 1959.

18. Mayo, C. W.: DeWeerd, J. H., and Jackman, R. J.: Diffuse Familial Polyposis of the Colon, Surg., Gynec. and Obst., **93**:87, 1951.

19. Dukes, C. E.: Cancer Control in Familial Polyposis of the Colon, Dis. Colon & Rectum **1**:413-423, 1958.

20. Neel, J. V.; Bolt, R. J., and Pollard, H. M.: A Pedigree of Multiple Polyposis of the Colon, Gastroenterol. **26**:1, 1954.

21. Dockerty, M. D.: Pathologic Aspects in the Control of Spread of Colonic Carcinoma, Proc. Staff Meet. Mayo Clin. **33**:157, 1958.

22. Mayo, C. W., and Wakefield, E. G.: Disseminated Polyposis of the Colon; New Surgical Treatment in Selected Cases, A.M.A. **107**:342-348, 1936.

23. Lilienthal, H.: Hyperplastic Colitis: Extirpation of the Entire Colon, the Upper Portion of the Sigmoid Flexure and Four Inches of the Ileum, Am. Med. **1**:164, 1901.

24. Lockhart-Mummery, J. P.: Diseases of the Colon and Rectum. Baltimore: William Wood and Co., 1934, p. 234.

25. Coffey, R. C.: Colonic Polyposis with Engrafted Malignancy; Technic for Removing Entire Colon Including Rectum, Ann. Surg. **83**:364, 1926.

26. Rankin, F. W.: Total Colectomy for Polyposis of Colon and Rectum, Proc. Staff Meet. Mayo Clin. **5**:118, 1930.

27. Boehme, E. J.: The Surgical Treatment of Familial Polyposis of the Colon, Ann. Surg. **131**:519-532, 1950.

28. Hickman, C. C.: Colectomy for Polyposis of Colon, Clinics, **3**:1066, 1944.

29. Bacon, H. E.; Villalba, G. L.; Sauer, I., and Martel, J. C.: Adenomatosis of the Colon and Rectum, J. Southern M. A. **50**:630-636 (May) 1957.

30. Hubbard, T. B.: Familial Polyposis of the Colon: the Fate of the Retained Rectum after Colectomy in Children, Ann. Surg. **23**:577, 1957.

ADDITIONAL SOURCES

Babcock, W. W.: Cited by Bacon, H. E.: Anus, Rectum and Sigmoid Colon. Philadelphia: The J. B. Lippincott Company, **1**:301, 1949.

Bacon, H. E., and Trimpi, H. D.: Surgical Management of Ulcerative Colitis, J.A.M.A. **153**:1249-1253, 1953. The Selection of an Operative Procedure for Patients with Medically Intractable Ulcerative Colitis, Surg., Gynec. & Obst. **91**:409-420, 1950.

Mayo, C. W., and Broders, C. W.: The Results of Subtotal Colectomy and Ileoproctostomy in the Treatment of Chronic Ulcerative Colitis, Surg., Gynec. & Obst. **104**:180-182, 1957.

Ravitch, M. M., and Sabiston, D. C.: Anal Ileostomy with Preservation of the Sphincters: A Proposed Operation in Patients Requiring Total Colectomy for Benign Lesions, Surg., Gynec. & Obst. **84**:1095, 1947.

Ravitch, M. M.: The Surgical Approach to Ulcerative Colitis, Wisconsin M. J., March 1959.

Ripstein, B.: Judgment Necessary in the Surgical Approach to Ulcerative Colitis, S. Clin. North America **38**:1355-1359, 1958.

That humanity has three aspects—science, art, religion; we know, we feel, we believe. But the third, which is perhaps the most important of all, which underlies the others, is least often acknowledged. Many writers speak of the science and art of medicine, but none since Sir Thomas Browne has written of the religion of medicine. The three are necessary to a sane and balanced whole; for just as science and religion without art produce the fanatic, art and religion without science the mystic, so science and art unleavened by faith produce the virtuoso, the technical expert. The faith of medicine is expressed in the Hippocratic oath: "The course I adopt shall be for the benefit of my patients, according to my ability and judgment." The welfare of the patient is the end we seek in surgical decision, which thus becomes the surgeon's religion, a faith that must sometimes repudiate science and transcend diagnosis.

—Ogilvie

Editorial

The Development of Otorhinolaryngology and Bronchoesophagology

(Continued from January issue)

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THE past century of rhinology has concerned itself with function as well as with disease entities which may affect the nose and its accessory sinuses. Since the turn of the seventeenth century (1804), when J. F. L. Deschamps (1740-1824) published the first treatise concerned with this area, much has been added to the knowledge of structure and function of the nose and sinuses. It was not long before the end of the seventeenth century that significant works by Morell Mackenzie and Ingalls, Grünwald, and Bosworth, among others, made their appearance.

While the world awaited the answers to many practical problems in rhinology, the literature was advancing in the direction of preserving and improving function. It appears significant that there were extremes of conservatism and radicalism evident in the management of conditions that affected the nose and sinuses. These undulations were due in essence to lack of understanding of function as well as pathogenesis. In some areas, the unknowns still remain so and will account for the absence of uniformity in treatment, and the challenge of improving and advancing

During the months of 1960 and as long thereafter as possible, the editorial pages of the Journal of the International College of Surgeons *will be honored by presentations of rare and extraordinary historic value, the lectures presented at the International Surgeons' Hall of Fame on medical and surgical history from the earliest recorded achievements to those of our own times. We believe that* Journal *readers who were not able to attend the lectures will find them as exciting as did the audiences present at their delivery. The story of progress in the healing arts and the giants of medicine and surgery to whom we owe the amazing brilliance and scope of modern achievements is intrinsically thrilling and is a vital part of the education of every cultivated man and woman, inside or outside the profession. It is altogether fitting that it should appear in these pages, since the International College of Surgeons is first, last and always a teaching institution.*

*Presented as an address at the International Surgeons' Hall of Fame, Chicago, May 5, 1959.

the present state of knowledge is forever before us. The names of Ross Hall Skillern, Arthur Proetz, Shaffer, van Alyea and many others are identified with the present era.

The existence of paranasal sinuses was known to the earliest practitioners of medicine. This is true especially of the frontal sinus, since wounds of the sinus were common at the time when darts and spears were used as weapons of warfare. The first reference concerning sinus disease is contained in the works of Hippocrates. He stated, "In a person having a painful spot in the head with intense cephalgia, pus, or water running from the nose or by the mouth or at the ears, removes the disease." The origin of the discharge was supposed to be from the brain. The case to which he refers was probably one of inflammation involving one or more of the paranasal sinuses. This cannot be proved, since no anatomic or pathologic description was given of the diseased sites.

After Hippocrates and the Greek center of learning, medical culture shifted to Alexandria, where medical progress is thought to have been associated with a fair degree of skill. The school and library were founded in Alexandria by the Ptolomies in 320 B.C. and progressed and remained the center of learning until 640 A.D., when the final destruction was completed by the wars with the Romans. During this period the study of anatomy became quite advanced, and it is inconceivable that in any dissection of the human body the paranasal sinuses could be overlooked. As a result of the Roman conquest, schools, libraries and practically all records were destroyed. It is difficult, therefore, to judge the progress made by the Egyptian anatomists and surgeons.

The next reference to the sinuses is noted in the writings of Galen (131-201 A.D.). He refers to the sievelike bones in describing the nose and was probably referring to the cribriform plate and the paranasal sinuses when he stated: "It has been stated before in regards to the perforation within the nostrils how wonderfully the bone situated in front of the ventricles of the brain receives them, being similar to a sponge and in regard to the passage of these into the mouth which is in the palate." Galen divided diseases of the nose into two classes, polyps and ozena. He stated, too, that "Sarcoma is an unnatural growth of flesh within the nostrils. Indeed, a polyp is a kind of sarcoma . . . A sarcoma differs from a polyp in size and structure."

From the time of Galen, research into anatomy and medicine declined for several hundred years. During this period Galen's views were considered the last word, and all scientific study was stagnated by the terrors of the Inquisition and by the political and religious thinking of the Middle Ages. With the relaxation of some of the horrors of the Inquisition, however, there was renewed interest in anatomic study.

In the early part of the sixteenth century, Berenger del Carpi, an instructor in surgery at Bologna from 1502 to 1527, described the sphenoid sinus. He thought it was the source of catarrh and denied that the ethmoid plate was pervious to the passage of the cerebral fluids. He thought this latter phenomenon took place through the sphenoid plate. Cloquet, in his writings, expressed the opinion that Berenger also noted the presence of the frontal sinuses. Vesalius, who became professor of anatomy at Padua and also taught at Bologna and Pisa and subsequently became court physician to Charles V of Spain, described the maxillary, frontal and sphenoid sinuses. He stated that these cells contained nothing but air. Fallopius, about 1600, described the sphenoid sinus and noted that it began to develop after the first year, became larger at the time of maturity, and that in the adult it was

double. He further noted that the frontal and maxillary sinuses were not present in the newborn. Some early authorities credited Casserius with discovering the maxillary sinus but since he was an anatomist at Padua at about 1600, it is noted that others described this structure many years before him.

Gabriele Fallopio, or Fallopius (1523-1562), described two types of intranasal growths, vascular hypertrophies which where to be found further back in the nose, and polyps which were edematous growths situated in more accessible parts of the nose. For the cure of the anterior growths he used a ligature, leaving it around the growth for two or three days, when it would fall off with the constricted mass. He stated "But when the polypus is well within the nose it is difficult to use the ligature, which should encircle the roots of the polyp. I take a silver tube which is neither too broad nor too narrow, and then a brass or steel wire, sufficiently thick, preferably the iron wire from which harpsichords are made. This double, I place in the tube so that from this wire loop is made one end of the tube, by which, used in the nares, I remove the polyp. When the polyp is engaged in the loop, I push the tube to the root of the polyp and extract it, since by this wire loop the root of the polyp is cut because it is a soft substance." Harder growths he pulled down so that he could cut off the roots with a knife.

During this time it is interesting to note the function which was ascribed to the paranasal sinuses. Early anatomists thought they held air or filtered it before it entered the brain. Placentinus believed them to contain a mucous humor which was distilled into the nares; others, such as Bartholinus, thought they made the voice more resonant. Fallopius, Veslingius and Jesson as early as 1601 thought they generated animal spirits. Spigelius thought they drew in odors. Jesson and Bartholinus believed the frontal sinuses contained a humor which moistened and lubricated the eyes. Paaw in 1763 thought they contained a viscid matter similar to the substance of the brain which draws air in so that it is better assimilated and prepared for the brain. Hermann Boerhaave (1668-1738) was under the impression that the acuteness of smell depended on the size of the frontal sinuses and also that they acted as reservoirs for the nasal secretion. He further remarked that the reason why children's noses were always running was the fact that the sinuses were not sufficiently developed to contain the mucus.

Alexander Read, in 1642, in his "Manual of Anatomy or Dissection of the Body of Man," speaks of the frontal sinus as being double in childhood but one in those of ripe age. These cavities, he stated, contained a clammy substance, kept in a green membrane. He thought they were for the retention of odor before it was carried into the brain. Haller, in 1763, thought the sinuses contained a thick fluid which was taken from the blood for the purpose of lubricating the nasal mucosa. Veslingius, however, in 1642, stated: "There is much doubt as to their use." Nathaniel Highmore (1613-1685) in 1651 gave the first accurate description ("Disquisitio Anatomica") of the maxillary sinus, later named for him as the antrum of Highmore. He presented an illustration of the sinus as he observed it and in addition reported a case of suppuration of the maxillary sinus caused by an abscess of a canine tooth and relieved by pulling the tooth.

In 1660, Conrad Victor Schneider (1614-1680) wrote a treatise "De Catarrhis." This constitutes the first description of the nasal mucosa, the Schneiderian membrane. He proved the fallacy of much of the early thinking concerning the sinuses, insisting upon the impermeability of the base of the skull to liquids and air. He showed that the origin of the nasal

discharge could not be from the cranial cavity and that even if formed there it could not get out, since neither the cribriform plate, the nutrient canal of the sphenoid bone, nor the lacerated foramens are pervious, as had been claimed previously. He further noted that no fluid as viscid as mucus was found in the cranial cavity and also that the cranial nerves could not act as a point of entrance. He located the origin of the nasal discharge in the anterior and posterior pituitary membranes, as he termed the nasal and pharyngeal mucosa. He found that mucus could be squeezed out of the membranes of this area even in the dead subject. He stated that the anterior and posterior pituitary membrane, when normal, exudes the mucus moderately; when more is formed, the condition of "catarrh" results.

Little was written concerning the ethmoid cells. Galen referred to the porosity of the cribriform plate, remarking that the nasal bones were similar to a sponge. They were known to Paulus Ageneta. Watson, in his "Diseases of the Nose," published in 1875, was familiar with the ethmoid cells, for in his description of the nasal meatuses he states, "Each fossa communicates with four sinuses, the frontal above, opening with the anterior cells into the middle meatus through the infundibulum; the sphenoidal behind, opening into the superior meatus; the maxillary or antrum Highmorianum, opening indirectly into the middle meatus at the lower part of the infundibulum, and the posterior ethmoidal, opening into the superior meatus."

Watson was also familiar with the presence of two types of epithelium in the nose, the olfactory and the ciliated portion; the presence of numerous glands in the submucosa of the nose, and the variations in these glands in the sinuses. From this it is to be assumed that the anatomy of the ethmoid bone was well worked out before the latter part of the nineteenth century. In 1891 Bosworth published a paper on the various forms of disease of the ethmoid cells, and about the same time Grünwald published another on the affection of the frontal sinus in which ethmoiditis is mentioned.

Following, or coincidental with this period, there were a large number of contributions to the anatomy of the various sinuses. Zuckerkand (1882) is credited for initiating the study of modern sinusology by discussing the anatomy of the sinuses and the nose in a comprehensive manner. Others contributing at this period were Billroth, Woakes, Killian, Chiari, Jeanty, Ferreri, Grünwald, Tilley and Luc of the European school, while in the United States there were Casselberry, Bosworth, Bryan, Knight, Swain, Rice and Ingalls. In 1904 Harris P. Mosher wrote on "The Applied Anatomy of the Frontal Sinus," and in the following year the contributors to the literature were Myles, Leland, Coakley, Casselberry, Roe, Farlow, Gleitsman, and Behrens. Hanau W. Loeb, in 1907, presented the results of his numerous and painstaking experiments on the "Anatomy of the Middle Turbinate with Special Reference to its Topographic and Surgical Relations." J. P. Schaeffer contributed a classical monograph on the "Nose and Olfactory Organ," in which he discussed the embryology, anatomy and anatomical variations of the paranasal sinuses. A. Logan Turner, Ross Hall Skillern, Proetz and VanAlyea brought sinusology up to the present high standard of knowledge.

The development of surgical procedures on the sinuses was invariably linked with the study of the various types of pathology and also upon the ability of the surgeons to make a proper diagnosis. It has only been during the last 300 to 400 years that there is reference to operation upon a diseased sinus. Prior to this time the measures employed were those which dealt with fractures and injuries of violence,

especially to the frontal sinuses and the treatment of polyps and tumors of the nasal passages.

Regarding injuries, the following statement appears: "If from a wound in the forehead, blood and air emerges the wound will not be fatal but if no air emerges the wound will probably be fatal." From this we can deduce that the early surgeons were familiar with the different types of fractures of the frontal area of the head, and, even if they did not know of the sinuses as such, they had an idea as to symptomatology and possible prognosis.

Ambroise Paré in 1564 warned the surgeons against trephining the frontal sinuses as they are "filled with a white sticky fluid as well as air." Fabricus Hildanus discussed wounds of the frontal sinus as "not healing easily and often degenerating into fistulae and malignant ulcers." He further stated: "The wounds of these cavities have such a large communication with the eyes that I have seen acrid and corrupted pus which flows from these cavities fall upon the conjunctiva and push the eye out of place." Palfin, at a later date, gave four differential points to distinguish the frontal sinus from the cerebral cavity, in wounds of the head: "When one sees mucus coming out of the wound; when air is blown from the wound by expiratory effort with the nose and mouth closed; the penetration of injected bitter water from the wound into the throat; or it is discharged from the nose."

Nasal diseases, particularly polyps, have been prominently discussed in medical history from the earliest times. Cato the Censor (born in 232 B.C.) had a very poor opinion of doctors—in fact, of learning in general. Amid many recipes, amulets, charms and invocations, we find him prescribing his favorite, almost his only drug for nasal polyps: "If there is a polypus in the nose, rub together some dry wild cabbage leaves in the hand and place it at the nose and draw up the breath as much as you can. In three days the polypus will fall away. Nevertheless, for some days do the same; so that you may render the roots of the polypi entirely healthy." Hippocrates (460-370 B.C.) is credited with developing a technic for removal of polyps: A sponge of sufficient size to fill the nasal cavity having been selected, four strings, each one cubit in length, were attached to it and their free ends were tied together. A long, flexible, metal probe with an eye at one end was passed through the nostril and brought out at the mouth; the united ends of the strings were threaded through the eye of the probe, which was then drawn through the nose. The strings were then seized by the operating surgeon, and by forcible traction the sponge was drawn through the nose, the mass of the polyps coming with it. Regardless of whether the growths were removed by evulsion or by cautery, Hippocrates afterward applied a dressing consisting of honey, to which there was occasionally added some strong caustic; this was kept in contact with the parts by means of small leaden plates inserted into the nostrils. In the case of hard polyps, Hippocrates directed that the nostril should be slit open, in order that the tumor might be thoroughly extirpated, and the roots afterwards destroyed with a hot iron through a hollow tube used as a speculum. In another method for harder growths, perhaps what we identify as fibrous hypertrophies, Hippocrates employed the principle of the snare.

Lorenz Heister (1683-1758), the great German surgeon of the eighteenth century, speaks of polyps springing from the accessory sinuses and the cavities of the ethmoids, as a result of obstruction of one or more glands of the pituitary membrane. Giovanni Battista Morgagni (1682-1771), in 1761, made pertinent observations that, at postmortem, polyps were more frequent outside than inside the sinuses. He also approved of Valsalva's method of remov-

ing the lamella of bone on which the polyps grow, with the view of preventing recurrences.

J. F. L. Deschamps (1740-1824) published a "Treatise on the Diseases of the Nasal Fossae and Their Sinuses" in 1804. He divided nasal polyps into: (1) fungous and vascular; (2) mucous and lymphatic; (3) scirrhous, and (4) sarcomatous. His methods of treatment were: (1) the local application of astringents; (2) excision with guarded bistoury; (3) avulsion with forceps; (4) the knotted thread (which he ridicules); (5) chemical caustics and the actual cautery, and (6) ligature with a waxed thread, or with wire of pure silver. He recognized the symptoms of acute frontal sinusitis, described simple inflammation of the maxillary sinus and advocated treating the latter by opening the sinus through the alveolus of a bad tooth, if one were present, or through an opening above the alveolar border large enough to introduce a finger.

Friederich Theodor von Frerichs (1819-1885), in 1843, is said to be the first to refer to the surface of a polyp being similar to that of the surrounding epitheluim. Max Joseph von Chelius (1794-1876) whose "Handbuch der Chirurgie" was the standard textbook in Germany until the middle of the nineteenth century, regarded the nasal polyp as a local infiltration of the mucosa with serum. Sir James Paget (1814-1899) classed polyps as fibrocellular tumors, and his warm friend, Rudolph Virchow (1821-1902), the man credited with being the founder of cellular pathology, described them as myxomas. Theodor Billroth (1829-1894) ascribed the structure usually found in rectal polyps to those found in the nasal cavity and stated that they were nearly all edenomatous in structure. Intimately associated with subsequent contributions to the polyp literature concerned with the pathologic anatomy were such names as those of Hopmann (1883), Emil Zuckerkandl (1861-1921), Woakes (1885), Chiari (1887), J. H. Bryan (1889), Hajek (1896), Cordes (1893), Okada (1898), Gustav Killian (1860-1921), Uffenorde, Kubo and Hirsch (1929).

In 1872 Voltolini drew attention to the intimate connection between asthma and nasal polyps, asserting that the former disappeared when the latter were removed. He ascribed this to the reflex irritation of the mucosa propounded by Johann Müller in 1853.

The earliest reference to sinus suppuration is that given by Fernelius in the early part of the sixteenth century, when he stated "There forms sometimes abscesses around these places without fever or very much pain and after their rupture, I have seen true pus run in abundance from the nostrils, as it comes out of purulent ears and this without any prejudice to the general health." He made no notation of any surgical procedure. Molinette, in 1675, wrote: "In a patient suffering from terrible pain, they made a crucial incision on the jaw, and with the crown of the trephine penetrated into the antrum of Highmore which was the seat of the abscess."

William Cowper (1666-1709), who wrote the section on diseases of the nose in James Drake's "Anthropoligia Nova," published in 1706, gives a description of the alveolar process approach to the antrum in sinus suppuration. It was then known as Cowper's operation. He is also reported as having suggested the perforation of the antrum on its anterior surface.

Some believed that Cowper should not have been credited with originating the alveolar process operation. Morgagni claimed that Jean Henry Meibomius, who died in 1655, suggested it. A. A. L. M. Velpeau (1795-1867), on the other hand, thought that Zwingler before Meibomius pulled out teeth, dilated the alveoli and made an exit for the pus from the antrum.

Lemorier, a surgeon of Montpelier, in

1717 proposed to open the sinus more posteriorly between the malar tuberosity and the third molar tooth. Desault, in 1798, thought the opening should be made through the canine fossa. This method was later applied with more modern principles by E. G. F. Küster (1839-1930) in 1899, and was known as the Desault-Küster technic. Velpeau is reported to have advised perforation of the antrum through the nasal surface and fixing a lead cannula in the opening. Acel, after approaching the sinus by the method of Cowper, inserted a second cannula through a fistulous opening which had formed in the nose.

Jourdain, dentist and graduate in surgery, in 1765 presented to the Royal Academy of Surgery of Paris a method of probing the antrum by its natural opening, and then by suitable injections to restore it to normal. After this presentation, M. Allouel Jr. claimed that the credit for discovery of this procedure rightfully belonged to his father. He said his father had originated it in 1737 and in 1739 had used it with success in treating a patient who had a diseased antrum. It was the decision of the Academy, however, that Jourdain should be credited with the discovery, since Allouel did not publish his idea. The Academy further appointed a commission to test the efficacy of probing and irrigating the maxillary sinus through its natural ostium. They came to the conclusion that probing the natural ostium was impracticable, since the lateral wall of the nose was perforated artificially in more cases than were entered by way of the natural orifice.

Gooch, an English surgeon in the middle of the eighteenth century, and John Hunter (1728-1793), in 1778, suggested that in patients who no longer had molar teeth the antrum should be perforated from the nasal surface. John Hunter was very familiar with several procedures for treating an abscess of the antrum, but was more concerned with the olfactory nerve than with the sinuses.

At this time other surgeons were using one or more of the methods that have been mentioned. They also attempted to keep the openings into the sinuses from closing for several weeks. Callisen, in the eighteenth century, inserted a seton into the opening. Busch and Henkel also used a seton by placing it through a fistula in the floor of the orbit and bringing it out into the mouth by way of the alveolus. Weinhold, around 1810, went by way of the canine fossa into the antrum and then through the palatine vault.

Many of the early surgeons were familiar with tumors of the antrum. On the successful procedures, it is reported that Charles Wiseman (1622-1676), surgeon to King Charles II, cut into a man's cheek, sawed the alveolar area of the maxilla into pieces and took out the entire jaw and thereby cured the patient. At a later date, Dubertrand removed a tumor through the alveolar ridge; so did Acoluthus of Silesia, in 1693, removing part of the alveolar ridge and subsequently a tumor of the maxillary sinus.

It is of note that Paré had reported trephining the frontal sinus for injuries of this area. Morgagni (1761) stated that Littre conceived the idea of using a trephine. The trephine had also been used by Mangetus to remove a worm. The first reference to a more major procedure, however, is that of Runge in 1750, when he advanced the idea of obliterating the entire frontal sinus. This was carried out by trephining the wall and introducing a "bourdonet" rubbed with a mixture of triturated silver nitrate and balsam into the base of the sinus. This method seems to have been forgotten until it was reintroduced by Theodor Kocher (1841-1917), who recommended curettement and obliteration of the cavity by granulation tissue.

Juarasz of Berlin, in 1883, is credited

with being the first to sound the sinus through the nasofrontal duct. In 1884, Ogston recognized the importance of maintaining a pathway of drainage from the frontal sinus through the nose and recommended various methods ranging from conservative to radical. Schaffer, in 1890, designed his puncture operation; this, however, was found to be quite dangerous, as the cribriform plate was occasionally punctured. Henri Luc (1855-1925), in 1893, described his technic, which was similar to that of Ogston and was then known as the Luc-Ogston method.

During this period, several surgeons were suggesting more radical technics. In 1890, Nebinger-Praun described an external operation, and Janson (1894) advocated opening into the inferior wall through an incision near the supraorbital ridge. Kuhnt (1895) introduced his method of the external approach and suggested the use of a drainage tube through the incision, using silver nitrate or zinc chloride to granulate the sinus to bring about obliteration. Riedel (1898) suggested the removal of the anterior and inferior walls of the sinus. This, however, left a serious cosmetic defect. Gustav Killian (1902) recommended an operation similar to that of Riedel except that the supraorbital ridge was spared. Subsequent to this there were other technics suggested, but in principle they followed one or more of those already advocated.

Before the advent of cocaine the sphenoid sinus was not subjected to surgical exploration, except with reference to foreign bodies and neoplasms. Hyrtl (1882) noted that the sphenoid was entirely beyond the range of manual and instrumental attack. The work of Emil Zuckerkandl (1849-1910), published that same year, however, changed the entire concept and impetus to the subject of the sphenoid sinus by the study of its normal and pathologic anatomy. Schaffer was the first to open the sphenoid (1885), and he was followed by Berger, Tyrman, Rolland, Heryng, Rualt, Quenu, Clark, Cozzolini and others.

Operation on the ethmoid cells also received an impetus about this same time. The first attempt at external exenteration is credited to Kuhnt; Riban, an ophthalmologist, however, before this had recommended that orbital abscesses be drained into and through the ethmoid cells. Subsequently, both Grünwald and Kuhnt proved the practicability of this procedure. Prior to this time a number of surgeons were doing some types of intranasal ethmoid operations. This was evidenced by the various types of cutting forceps they designed, which are still retained and widely used.

As has been mentioned, Schaffer was the first to open the sphenoid sinus. He suggested enlarging the natural ostium by removing the anterior wall of the sinus down to the floor if possible, then introducing a curette into the cavity and removing its contents. Grünwald, in 1895, considered this method insufficient and suggested the additional removal of the lower wall. Hajek (1895) recommended radical removal of the anterior wall by means of posterior ethmoidal exenteration and the clearer visualization of the sphenoethmoidal recess. Similarly, there were other surgeons recommending other approaches to the sphenoid sinus. For example, Janson suggested opening the sinus by way of the maxillary sinus and the posterior ethmoid cells. Guisez (1902) advised approaching the sphenoid through the lamina papyracea and then by way of the posterior ethmoid cells. Killian suggested a frontal sinus procedure with the removal of all ethmoid cells, and then the removal of the anterior wall of the sphenoid sinus.

Incidental to the development and adoption of modern surgical principles to the surgical management of the frontal, ethmoid and sphenoid sinuses, progress

was being made in the surgical approach to the maxillary sinus. Bayer (1886) recommended approaching it by way of the natural ostium and enlargement of the opening by the employment of galvanocautery. J. von Mikulicz (1850-1905) suggested in 1896 the use of a bent trocar to perforate the lateral nasal wall in the inferior meatus to procure an opening into the antrum and then the employment of periodic irrigations in treatment. Some authorities have credited Mikulicz with the discovery of this method, but similar means of approach had been recommended by Velpeau, Gooch, and John Hunter a hundred years before. There is little doubt, however, that Mikulicz did much to popularize this procedure and demonstrate that it was a simple and practical method of treating antral disease. His original method was more or less discarded because the orifice tended to close and it became increasingly more difficult to find the opening, necessitating repeated cocainization of the inferior meatus each time it was attempted. As a result, Wileminsky designed a special trochar for the initial perforation and then enlarged the opening with a type of bone forceps such as those designed by Krause, Hajek and Wagener. Soon after Mikulicz brought out his procedure, Grant and Pegler, Lothrop and Claoue modified it by removing portions of the inferior turbinate.

Zuckerkandl previously had referred to the fact that the middle meatus was especially suited for making an opening into the antrum. However, Siebenmann is credited with being the first to practice this approach regularly and successfully. Onodi of Budapest (1903) also carried out this procedure and described a trochar for enlarging the opening. Another advocate of this method was Kubo.

The canine fossa as a point of entrance to the maxillary sinus had been described; its surgical application, however, did not take place until George W. Caldwell (1834-1918) in 1893, and Henri Luc (1855-1925) in 1897, working independently, recommended this procedure and additionally suggested that a counter-opening be established in the nasal cavity.

Subsequent to the reports of Caldwell and Luc, Boenninghaus (1897), Hajek (1902), Friedrich (1904), and Kretschman (1905), all recommended modifications of the technic, especially in the making of a flap of the mucosa from the nose to line the sinus, or in suggesting a slightly different method of approach. Denker (1905) suggested a modification in which the antrum is opened similarly to that in the Caldwell-Luc procedure; then the outer border of the pyriform aperture was exposed and the bony edge removed along with the lateral wall of the anterior portion of the nose adjacent to the sinus. Since that time there has been little change in the basic methods of surgical approach to the sinuses. Advances have been in the use of electrical devices, the employment of roentgen rays, radiopaque substances, improved instrumentarium, analgesics, anesthetics, vasoconstrictor drugs and, finally, antibacterial agents.

Plastic surgery became important in ancient Hindu medicine, as cutting off the nose and ears was the punishment decreed for adultery, theft and war crimes, and also was often done for revenge. Rhinoplasty was described as follows: "The physician should take a leaf of a tree, of the same size as the nose, and applying it to the cheek, cut a corresponding piece out of the cheek in such a way that a stem is still adherent. He then stretches the cheek with needle and thread, scarifies the stump of the nose and quickly but carefully places the flap of the cheek over it, attaches it with a good dressing and sews the new nose firmly on. He shall then carefully introduce two fitting tubes, in order to make breathing easier, and when thus raised he shall sprinkle it with oil and scatter on it red sandalwood, licorice and

antimony, whilst white cotton is laid carefully thereon and it is frequently sprinkled with sesame oil."

On the island of Sicily early in the fifteenth century, Branca (the elder, who supposedly followed the Indian method) and his son Antonio popularized the "Italian method" of restoring noses. The technic was essentially as follows: A model of the proposed nose was made out of parchment or leather, the exact size of the lost member. The model was laid on the part of the upper arm which, by raising and approximating the arm to the face, had been found most suitable. Then the outline of the model was traced upon the skin with ink or other coloring matter. With a sharp knife the portion of the skin thus marked was separated from above downward in such a manner that the lower portion would serve as a bridge or pedicle, extending the width of the fingers beyond the line of the model. This portion of the skin is not severed, but remains attached. The arm is brought up over the head, the flaps applied to the raw surface of the nose and attached by sutures, and the head and arm immobilized by bandages. About the eighth to the tenth day, when union has occurred, the pedicle is severed in such a manner as to form a flap of sufficient size to unite with the upper lip and to provide nasal openings. The flap is then attached to the freshened upper lip. Two quills covered with wax are inserted into the nasal openings and the nose properly molded.

In 1460, Heinrich von Pfolzpreunt, in a book on bandaging, described the Italian arm flap method of restoring noses. It was practiced by the Viancos family in Italy and described in the surgical writings of Fallopius (1523-1562) and Vesalius (1514-1564) in the middle 1500s.

Gaspare Tagliacozzi (1545-1590) occupied the chair of anatomy and surgery at Bologna for thirty years and is generally regarded as the father of autoplasty. His "De Curtorum Chirurgica" (tagliacation rhinoplasty technic), published in 1597, was seemingly based on the Italian arm flap method originated in Sicily by Branca almost two hundred years earlier. Theologians considered Tagliacozzi in league with the devil because he engaged in work they ascribed only to the Almighty (he was improving God's handicraft). Because he was creating beauty, he was a tool of the devil. After his death some nuns heard a voice exclaiming that he was damned, so they dug up his body and had it thrown out of holy ground as a revenge for his sacrilegious efforts. His medical colleagues had a statue made, and he stands immortalized with a nose in his hand.

After the time of Tagliacozzi the results of nasal surgery seemed to decline, and the opposition of the church also discouraged nasal operations. There is a hiatus of about two hundred years, therefore, during which the art was lost. Then, in 1794, there appeared an article in *Gentleman's Magazine* in London dealing with the forehead flap reconstruction, with drawings of the patient and procedure. Mr. Joseph C. Carpue, a London surgeon, took up this work, practiced it and wrote a small book about it.

The revival of interest in plastic surgery was largely due to the work of the German surgeon Johann Friedrich Dieffenbach, who wrote widely on the subject during the third and fourth decades of the eighteenth century. Numerous European and American surgeons soon followed in his footsteps. With the impetus from the introduction of anesthesia and aseptic methods, and the needs created by two world wars, plastic surgery blossomed to the important place it now holds.

Viable tissue support for nasal reconstruction was tried in the middle of the nineteenth century. Periosteum from frontal bone, frontal bone itself, rib periosteum, ulnar bone, the denuded finger

(dactylocostal rhinoplasty) and free tibial grafts (1896) were all used. In 1900 rib cartilage was used to correct a saddle nose. Probably the first rhinoplasties performed in the United States were recorded in 1887 by John Roe. In 1891 he advocated hump removal, demonstrating "before and after" photographs.

In 1892 Robert F. Weir restored a saddle nose with a "young duck's breast bone." The results were excellent for three weeks, but by the end of the eighth week the exogenous tissue had to be removed.

Jacques Joseph, a Berlin orthopedic surgeon, in 1898 reported on the surgical correction of nasal deformities. His surgical procedures and his book (1938) heralded a new era in rhinoplastic surgery.

Hippolyte Cloquet (1787-1840) in 1821 published a 750-page work on the nose, which professed to deal mainly with the physiologic aspect of olfaction and only incidentally with affections of the nose. He described septal deviations he considered irremediable; he dealt fairly well with fractures of the nose and rhinoplasty and less adequately with nasal disease. Langenbeck (1842) was apparently the first to describe so-called ecchoneuroses and exostoses of the nasal septum as crests and spurs, but it was not until Adams, in 1875, had recommended forcible fracture of the septum and its support by splints that surgical therapy was applied to the septum, especially encouraged by the application of cocaine as an anesthetic by Aurep in 1880.

In 1882, Ingalls of Chicago described the first "submucous resection" approach to the problem of obstruction caused by septal deviation. In Europe, and apparently unaware of Ingall's work, Krieg (1886) and Boenninghaus (1895) described submucous septal work more extensive than Ingall's removal of anterior cartilage deflections. In Chicago, unaware of Krieg and Boenninghaus' writings, Otto Freer (1902) developed a septal operative technic that demonstrated great powers of observation, analysis and inventive enthusiasm for this new method of nasal surgical treatment. He advocated many of the procedures that are still used. He also analyzed the anatomic deformities of the cartilage and bone of the septum and designed an instrumentarium to simplify the problems.

Laryngology and Bronchoesophagology.—One hundred years ago, a view of the larynx, tracheobronchial tree and esophagus was only a matter for viewing on the postmortem table. Astute clinicians could but assume that certain changes were taking or had taken place. Modern technics of indirect and direct laryngoscopy add much to the knowledge of causes of alterations of the voice and have enabled observers to gain a better understanding of the physiologic character of phonation. The tracheobronchial tree and the esophagus, likewise, become revealed in the interest of a better understanding of physiology and anatomy.

One of the truly great contributions to the scene has been the work of Paul H. Holinger in the field of photography, enabling workers in the field to record photographs of these areas in both health and disease, and thus serving an important function in disseminating knowledge and understanding of laryngology and bronchoesophagology.

Efforts in the field of phonetics—the integrative approach to the problems of speech disorders—deserve special commendation. Advances in rehabilitation have been achieved in the area of voice deprivation resulting from complete surgical extirpation of the larynx, and excellent surgical technics have been developed for those who have bilateral paralysis of the larynx. Assessment of the advances of the past century would be incomplete were not mention made of the development of attitudes and technics (surgery, anes-

thesia, blood and blood substitutes and prosthetics) in combating malignant tumors involving more than just an isolated portion of a true vocal cord.

Asclepiades is mentioned by Galen (131-201 A.D.) and Aretaeus (80-160 A.D.) as the first surgeon to perform a tracheotomy. Galen used the phrase "to cut the larynx" and Aretaeus "make an incision in the artery." In ancient Greek writings the words "the artery" and "bronchus" meant the windpipe and included the larynx. Galen also used the words "the artery," "the cough artery" and "bronchus," all meaning the windpipe. Caelius Aurelianus (fifth century) termed the operation the "division of the artery" or laryngotomy. Paul of Aegina (625-690), a great Greek physician, wrote a chapter on "laryngotomy" and quoted from Antyllus (second century A.D.) that the arteria aspera should be divided at about the third or fourth ring. Antyllus called the operation pharyngotomy.

The words "cough artery" were employed by writers after the beginning of the Christian era as a designation of the windpipe below the larynx. After many centuries the word "artery" slowly lost popularity and the structure was referred to as the trachea—a term employed by Fabricius of Aquapedente (1537-1619), Julius Casserius (1545-1605) and Lorenz Heister (1683-1785). It was not until the nineteenth century that "trachea" alone was used.

Rhazes (ninth and tenth centuries) refers to it as "incising the canalis pulmonis between two rings." Albacusis (1013-1106) called the operation "sectio epiglotis"; Avicenna (tenth and eleventh centuries) "scisio cannal" and Avenzaar (1126-1198) "incisio cannal pulmonis."

Pierre d'Abano called the operation "Sub cannatio incisio asperae arteriae"; Fabricius of Aquapedente called it "perforation of the aspera arteria"; Julius Casserius used only the term "laryngotomy." Nicolas Habicot in 1620 first described the operation under the term "bronchotomy." He suggested that the procedure be called "larynbronchotomie."

The word "tracheotomy" first appeared in the "Libri Chirurgiae XII" of Thomas Feyens or Fienus (1567-1631), Professor of Medicine at Louvaine. Tractatus IV of the book is headed "De Tracheotomia." Sanctorius of Justinopolis advised the use, in 1625, of a trocar and cannula to open the trachea in children with a disease that was possibly diphtheria. The designation "tracheotomy" did not become popular, and writers continued to use the terms "laryngotomy" and "bronchotomy" indiscriminately for nearly another century.

In 1718 Lorenz Heister reintroduced the word "tracheotomy" in his *Chirurgie* and recommended that the other names be discarded. It was Desault (1744-1795) who distinguished between laryngotomy and tracheotomy.

According to E. Fletcher Ingals, Professor of Diseases of the Chest, Throat and Nose, at Rush Medical College late in the nineteeth century, the credit for having discovered the art of laryngoscopy is usually given to Johann Neopomuk Czermak of Pesth (Budapest, Hungary), but apparently many investigators before his time had experimented more or less successfully in illuminating the larynx. Phillip Bozzini of Weimar, in 1807, published a description of an instrument for examining the throat. It consisted of a curved speculum divided by a partition and fitted with two mirrors at its angle. One mirror was intended to convey the light, the other to receive the image. This arrangement is unnecessary, for one mirror can serve both for reflecting light and for receiving the image. A wax candle with a reflector supplied the illumination, but it is not likely that Bozzini ever saw any parts of the larynx with his speculum.

L. Senn of Geneva, in 1827, published an account of an attempt to view the upper part of the larynx with a mirror, suggesting its use in the diagnosis of laryngeal tuberculosis. Bennatti (1832) and Avery of London (1844) attempted to illuminate the larynx by means of artificial light conducted through tubes; but, as has been shown by Armand Trousseau and J. H. Bellocq, who wrote an outstanding treatise on laryngeal tuberculosis in 1837, these instruments crowded the tongue and epiglottis before them so as nearly to close the orifice of the larynx. At most, they could expose only a small portion of its posterior wall.

About one hundred years previous to these efforts, Levret of Paris, an eighteenth century surgeon, probably the first experimenter in this direction, attempted to see the larynx by means of a polished steel plate used as a tongue depressor. On March 18, 1829, before the Hunterian Society of London, Benjamin Guy Babington (1794-1865) described a laryngeal mirror similar to those used today. On this he concentrated the sun's rays by means of a hand mirror. He called the instrument a "glottiscope" and apparently used it on many patients. There is no evidence, however, that Babington ever saw the movements of the vocal cords, for he recorded no cases, and he had no pupils or followers.

Another unsuccessful effort to view the larynx was made by Robert Liston of London. In 1840 he suggested that a view of the laryngeal parts may be obtained by means of "a glass as is used by dentists on a long stalk previously dipped in hot water, introduced with its reflecting surface downwards and carried well into the fauces." It is doubtful that he ever carried out such an examination, since he emphasized careful palpation with the fingers to establish the existence of a swelling.

In 1844, Adam Warden of Edinburgh had the idea of employing a prism of flint glass for obtaining a view of the larynx, using a powerful Argand lamp with large prisms attached for illumination. He was so unsuccessful that he was forced to the conclusion that his method would give no assistance in the investigation of disease below the pharynx. In the same year, John Avery of Charing Cross Hospital, London, was attempting to visualize the vocal cords with the aid of a speculum and reflector. He employed a large circular reflector (like Czermak after him), used to increase the luminous power of a candle held at a short distance from the patient's mouth. The reflector was attached to a frontal pad and mounted on the operating surgeon's head. The speculum was similar to that used by Bozzini. The laryngeal mirror instead of being fixed to a slender shank, was placed at the end of a speculum. It was very difficult, if not almost impossible, to introduce Avery's speculum without irritating the base of the tongue and causing retching. This and the cumbersome reflecting apparatus are responsible for the failure of Avery's laryngoscopic method.

Until the invention of the indirect (mirror) laryngoscope, the larynx, as well as other internal structures situated beneath the level of the oropharynx, remained hidden from view and could be examined only at the necropsy table. Consequently, the majority of laryngeal lesions remained undiagnosed and inadequately treated, if treated at all. Laryngology, as it existed, came under the realm of the physician in view of its inaccessibility to surgeons practicing in the prelaryngoscopic era.

In spite of the inability to visualize the larynx, a number of operative procedures undertaken for the removal of tumors of this structure were reported. Prior to 1840, Sir Astley Cooper (1768-1841), the most popular and successful surgeon of the Georgian era, is said to have removed

with his finger a large carcinomatous tumor, about the size of a hen's egg, from the under surface of the epiglottis. Up to the year 1850, 31 cases of laryngeal tumors were reported in the literature. Horace Green (1862-1866), the pioneer American throat specialist, was one of the few to remove a laryngeal tumor before the invention of the laryngeal mirror. When the patient opened his mouth widely and coughed, a round, white, fibrous looking tumor, about the size of a cherry, could be seen arising from the larynx. Green seized it with a tonsil forceps and divided it with a knife. Before his time it was considered impossible to introduce any instrument into the larynx, and when Green said that in 1838 he had applied a silver nitrate solution within the larynx with a curved applicator, his statement was received with incredulity. His claim was condemned as an anatomic impossibility and an unwarranted innovation in medical practice. He was attacked by his contemporaries, forced to resign from the medical society to which he belonged and threatened with expulsion from the Academy of Medicine. He did, however, live long enough to see his claims for intralaryngeal medication justified.

The first to demonstrate the larynx in the living subject was Signor Manuel Garcia, a teacher of vocal music in London. He became quite expert in autolaryngoscopy and also succeeded in demonstrating the larynx in others. How his wish to view the larynx became realized during a vacation in Paris is expressed in his own words:

"One September day, in 1854, I was strolling in the Palais Royal, preoccupied with the ever-recurring wish so often repressed as unrealizable, when suddenly I saw the two mirrors of the laryngoscope in their respective positions, as if actually present before my eyes. I went straight to Charriere, the surgical-instrument maker, and asking if he happened to possess a small mirror with a long handle, was informed that he had a little dentist's mirror, which had been one of the failures of the London Exhibition of 1851. I bought it for six francs. Having obtained also a hand mirror, I returned home at once, very impatient to begin my experiments. I placed against the uvula the little mirror (which I had heated in warm water and carefully dried); then, flashing upon its surface with the hand mirror a ray of sunlight, I saw at once, to my great joy, the glottis wide open before me, and so fully exposed, that I could perceive a portion of the trachea. When my excitement had somewhat subsided, I began to examine what was passing before my eyes. The manner in which the glottis silently opened and shut and moved in the act of phonation filled me with wonder."

His observations, entitled "Physiological Observations on the Human Voice," were first communicated to the Royal Society of London in 1855, laying emphasis on what he could see and not on the instrument. It attracted little attention at first, for the art was thought to be of no practical value in the diagnosis of disease, because a thorough inspection was supposed to depend upon a peculiar education of the muscles that would enable the patient to control the position and movements of the throat. Garcia's writings, however, induced Ludwig Türck, a well-known Viennese neurologist, to experiment with similar mirrors, apparently unaware of Garcia's work, in the summer of 1857, but he gave up with the coming of autumn because of the difficulty of obtaining sunlight. His experiments were not lost, for Czermak, a physiologist, who had been visiting Vienna during the summer, borrowed the mirrors and continued the investigations. He overcame the difficulties that had formerly prevented a clear view of the larynx, by employing the reflector, a mir-

ror held in his teeth, by causing the patient to protrude the tongue instead of depressing it, and by substituting artificial light for sunlight. In March 1858 Czermak read an important paper on laryngoscopy before the Academy of Sciences of Vienna, and insisted on giving credit to Garcia for the invention of the laryngoscope. In 1859, Czermak also turned his mirror upward and, with the aid of a palate retractor, was able to demonstrate the nasopharyngeal cavity. The method was further developed and simplified by Friedrich Voltolini in 1861. Both Czermak and Türck published papers on the use of the laryngoscope and gave rival public demonstrations in its art. Ill feeling between Türck and Czermak increased so greatly that the former threatened legal action in the High Court of Vienna. Each made claim to the Monthyon Prize of the French Academy of Science of the Imperial Institute of France in 1860. A special commission appointed to study their claims decided "with Solomon-like wisdom: to divide the 2400 franc prize between them."

It appears that while Manuel Garcia was the first successful laryngoscopist, Ludwig Türck was the first to apply the laryngoscope to medicine and Johann Czermak the man who developed the instrument and popularized it with the medical profession. Garcia was acclaimed as the true "Father of Laryngology." In recognition of his discovery, which, incidentally, created a new medical specialty, Garcia, when he reached the age of 100 (he died at 102), was honored with a celebration organized by Sir Felix Semon, the like of which has yet to be equaled. On March 17, 1905, the King of England awarded him the insignia of the honorary Commandership of the Royal Victorian order. King Alphonso XIII of Spain, through the Spanish charge d'Affaires in London, invested Garcia with the Royal Order of Alfonso XII. By the German Emperor he was awarded the Great Gold Medal for Science, which is a rarely awarded distinction. Addresses and messages of praise were sent from laryngological societies, and delegates came from universities, medical colleges, colleges of music and scientific bodies all over the world. He was presented with a portrait of himself painted by John Singer Sargent, for which subscriptions were received from laryngologists. Garcia never meant to become a founder of a new specialty and protested that the mirror only cost him six francs!

One thing is certain about Ludwig Türck, namely, that his Atlas, *Klinik der Kehlkopfkrankheiten*, published in 1866, is remarkable for its twenty-four chromolithographic plates showing a wide variety of laryngoscopic views and postmortem specimens. This heralded an era when guesswork was removed from alterations in voice. The disease entities were recognized but not necessarily cured. Syphilis had to await its salvarsan and penicillin, tuberculosis required dihydrostreptomycin, and tumors had to await refinements of direct laryngoscopy and external surgical treatment of the larynx.

Prior to the bronchoscopic era, foreign bodies in the air passages were treated by the administration of emetics and sternutatories to promote their expulsion. Frequently, the patient was inverted or hung up by the feet, and his chest or back struck with the hand. The first extensive coverage of this subject was by Louis, *Memoir on Bronchotomy*, before the Royal Academy of Surgeons at Paris in 1759. In 1819 there was a paper in the *Transactions of the Medical Society of the State of New York*—a report of the removal of a bean from the bronchus by bronchotomy (tracheotomy). Samuel D. Gross, a general surgeon, in his monumental *A Practical Treatise on Foreign Bodies in the Air Passages*, written in 1854,

recognized the danger of laryngospasm if these methods were resorted to without previously performing a tracheotomy. He advised early "bronchotomy" to guard against such a complication and to provide an orifice through which instruments (long hooks and tenaculae) might be passed for attempted extraction of foreign bodies. If the foreign body could not be retrieved, to prevent its harmful effects, expectorants and purgatives were administered, and bleeding, counterirritation and the application of leeches were resorted to. Needless to say, the mortality rate from this approach was very high, varying from 30 to 50 per cent.

One of the first to whom occurred the idea of examining the various cavities of the body by endoscopic means was Bozzini of Frankfort, who in 1806 devised a primitive endoscope for direct examination of the urinary bladder or the rectum. His laryngoscope has already been mentioned. This was one of the tubes he unsuccessfully endeavored to use in conjunction with his light conductor, consisting of a convex, vase-shaped stand, the "lamp holder," which was made of tin covered with leather, except in its upper third, which was of uncovered brass. With a candle inside, one-half of the lamp holder provided the light, the other half having an opening in the posterior wall for observation. Bivalved tubes of various lengths and diameters were attached to the opening in front of the lamp holder. The rays of light from the candle were reflected into the examining tube. This instrument was condemned by the Medical Faculty of Vienna and looked upon as an impractical toy.

John D. Fisher of Boston, in 1824, devised a similar apparatus consisting of three cylindric tubes united at right angles and containing lenses for magnification. The illumination was by candlelight. In 1826, Segales of Paris improved Bozzini's apparatus by constructing a urethrocystic speculum. He suggested it could be used for examining other orifices by altering its dimensions. John Avery (1848) also devised a primitive endoscope.

The pioneer of practical endoscopy was A. J. Desormeaux of Paris, who in 1853 introduced an apparatus lighted by a gasogen lamp and identical in principle to that of Fisher, but intended as a urethroscope. He worked for more than thirteen years accumulating facts to demonstrate the value of this method of investigation and treatment of diseases of the bladder, rectum, uterus, auditory meatus, pharynx and larynx. He has, however, been called "The Father of Endoscopy." Richard Cruise, of Dublin, in 1865 modified Desormeaux's endoscope by improving the illumination. He pointed out that it could be of service in examining any portion of the body into which a straight tube could be inserted. He was the first to mention the possibility of direct examination of the air and food passages. He used an oil lamp.

Kussmaul of Frieburg, in 1868, using the elongated urethroscope of Desormeaux, was the first to perform direct esophagoscopy, by using as his subject a sword-swallower, sitting in the sword-swallowing position. Kussmaul demonstrated a carcinoma of the thoracic esophagus. His pupil Muller showed that a rigid tube 13 mm. in diameter could be introduced safely into a normal esophagus. Later, also in 1868, Waldenburg of Berlin and Stoerck of Vienna, employed an 8 cm. gum-elastic tube which could be introduced into the esophagus, the illumination being obtained by use of the laryngeal mirror. Other tubes were developed by Toruve, Voltolini, O'Dwyer and Rosenheim.

Morell Mackenzie, in 1880, designed a collapsible skeleton-like esophageal tube that could be introduced into the cervical portion of the esophagus, flattened, and

expanded when in place. Illumination was indirect, the mirror being attached to the upper portion of the tube.

Von Mikulicz of Vienna, in 1881, designed a practical esophagoscope, a straight, rigid tube with a slanting distal end, illuminated by means of an interior platinum wire. His anatomic, physiologic and pathologic investigations of the esophagus formed the basis of knowledge of esophagoscopy. He is the acknowledged founder of esophagoscopic technology, the "Father of Esophagoscopy."

Von Hacker, in 1889, improved Von Mikulicz's esophagoscope and designed special endoscopic instruments, bringing the method of esophagoscopy to greater perfection. Gottstein of Breslau, in 1891, was the first to design and use esophagoscopes with an additional tube inserted in their walls for the purpose of suction. He also was the first to use topical cocaine analgesia instead of general anesthesia.

Up to this time, laryngologists could view the larynx only by indirect means. Joseph P. O'Dwyer (1841-1898) of New York, in 1880, devised an intubation tube to be used in the treatment of diphtheria and for the expulsion of foreign bodies in air passages. This tube, and the invention of electric light in 1878 by Edison, laid the foundation for direct examination of the larynx and tracheobronchial tree.

On April 23, 1895, Kirstein of Berlin for the first time viewed the interior of the larynx by direct examination, using a flat spatula and a prismatic incandescent lamp, with the patient's head extended and the tongue depressed. He, von Hacker and Mikulicz reported the first direct examinations of the trachea through rigid tubes. Gustav Killian (1860-1921) of Freiburg, frequently referred to as the "Father of Bronchoscopy," was impressed by the work of Kirstein and began to devote his entire time to endoscopy. He demonstrated that the rigid tubes with proximal lighting could be passed into the bronchi and in 1897 removed a bone from the right bronchus, the first time such a feat had been accomplished. In 1912 he was the first to present suspension laryngoscopy.

In America, the first article to be published on esophagoscopy was written by Einhorn of New York in 1897, and in 1902 Einhorn designed the first tube with distal illumination. The conducting wire was carried to the light by means of an auxiliary tube in the wall of the main tube. He was followed by E. Fletcher Ingals of Chicago, who in 1904 devised a separate light carrier in a Killian tube, and fashioned a spatula for direct laryngoscopy. Ingals also introduced respiratory apertures for the bronchoscope.

The name of Chevalier Jackson (1865-1958) is synonymous with present-day endoscopy. After his graduation from Jefferson Medical College in 1886, Jackson visited Morell Mackenzie's clinic in London and observed him using his skeleton esophageal tube. In 1904 Jackson improved the distal lighting principle, designed a light carrier and attached a useful right-angled handle to the endoscopic tube. He was the author of the first book devoted to the subject — *Tracheo-bronchoscopy, Esophagoscopy, and Gastroscopy,* published in 1907.

After Killian developed suspension laryngoscopy in 1912, and a self-retaining laryngoscope, he was followed by his assistants von Eichen and Bruning, Albrecht, Steiner, Seiffert, and Haslinger, and in the United States by Lynch and LeJeune, Roberts, Andrews, Douglas and Lewy. Bruning at Jena advanced in the armamentarium and teaching of proximal lighting endoscopy.

Numerous modifications of earlier instruments have become obsolete, but certain of them, such as the built-in side tube for aspiration or the lens-capped endoscopic lamps, are of established value. The

experience of the past twenty-five years has produced many accessory instruments for use in endoscopy, and the modern endoscopist can remove a specimen for biopsy or aspirate a bronchial secretion with an instrument so adapted in shape and material that minimal trauma is caused to the tissues. Modern roentgenographic methods, including tomography and biplane fluoroscopy, are essential in locating aspirated foreign bodies, as well as the use of radiopaque mediums (bronchography was introduced in 1918) in demonstrating bronchial disease.

Therapeutic endoscopy was introduced by Novotny of Poland in 1907, with the application of epinephrine by means of a bronchoscope to provide relief in cases of asthma. This has been extended to include the aspiration of purulent material in cases of bronchiectasis or pulmonary abscess, the treatment of atelectasis, the local treatment of strictures and benign tumors, etc. The use of radium by means of an esophagoscope in treatment of carcinoma of the esophagus has had some encouraging palliative results since it was introduced by Guisez of France in 1908.

Endoscopy has outgrown its limited sphere of usefulness in removal of foreign bodies from the air and food passages. The etiologic, pathologic, symptomatologic, diagnostic, prophylactic and therapeutic data on the tracheobronchial tree and esophagus have become the main indications for the procedure. The diagnostic value of peroral endoscopic study has come to be realized by the medical profession at large.

BIBLIOGRAPHY

Babington, B. G.: Glottiscope. London M. Gaz. 3:555, 1829.

Babbitt, J. A.: History of Endaural Surgery: Surgery of the Ear. New York: Koretzky Nelson and Sons, 1938.

Ballance, C. A.: Essays on Surgery of the Temporal Bone. London: MacMillan & Co., Ltd., 1719.

Bozzini, P.: Der lichtleiter, Weimar 1807 (translation).

Bezold and Siebenmann: Textbook of Otology, Translated by J. Holinger, M.D.

Castillo, J. M.: Manuel Garcia, Inventor of the Laryngoscopic Method: Reply to Dr. Walter A. Wells, Laryngoscope 58:1133, 1948.

Chauveau, C.: Historie des maladies dy Pharynx. Published in 5 volumes between 1901 and 1906. Dealt in great detail with the history of diseases of the pharynx up to 1875. Paris.

Clerf, L. H.: Historical Notes on Foreign Bodies in the Air Passages, Ann. Med. History, N.S. 8:547, 1936. Progress in Bronchology. J.A.M.A. 733 (Mar. 13) 1948. Historical Aspects of Foreign Bodies in the Air and Food Passages, Ann. Otol., Rhinol. & Laryngol. 61:5, 1952.

Czermak, J. N.: Der Kehlkopfspiegel und seine Verwendung. Leipzig: Engelmann, 1860.

Dench, E. B.: Textbook of Ear, Nose and Throat. New York: Appleton & Co., 1894.

Desormeaux, A. J.: Endoscopy and Its Application to the Diagnosis and Treatment of Affections of the Urethra, Paris 1865.

Duel, A. B.: Suppurative Labyrinthitis: A Critical Review of Its Diagnosis and Treatment, Boston M. S. J. 176:345-351, 1917.

Duverney, J. (1648-1730): Tractatus de Organo Auditus, Continens Structuram, Usum, et Morbos Omnium Auris Partium. E. Gallico Latine Redditus, Versio Nova et Accuratior. With 16 folding plates. 76 pp. Lugduni Batavodum, 1730. (This pioneer tract was originally published in 1638).

Furstenberg, A. C.: A Chronicle of One Hundred Years of Otolaryngology, Bull. New York Acad. Med. 25:775, 1949.

Garcia, M.: Observations on the Human Voice, Laryngoscope, 15:185, 1905. Physiological Observations on the Human Voice, London, Edinburgh and Dublin Philosophical Magazine 10:218, 1855.

Goodehl, E. W.: Story of Tracheotomy, Brit. J. Child. Dis. 31:167-176 and 252-272, 1934.

Green, H.: Treatise on Diseases of the Air Passages, etc., New York, 1846.

Gross, S. D.: A Practical Treatise on Foreign Bodies in the Air Passages. Philadelphia: Blanchard and Lea, 1854.

Guthrie, D.: The History of Otology, J. Laryng. & Otol. 55:446, 1940.

Holinger, P. H.: Progress in Esophagology, Arch. Otol. 47:119, 1948.

Holmes, W. G. (1846-1927): History of the Progress of Laryngology from the Earliest Times. (The author was an English laryngologist; a classical scholar, originally from Dublin. Published in Med. Press and Circular in 1885; never republished in English, although French and German translations [by Calmettes and by Koerner] were published in 1887.)

Holmgren, G.: Surgery of the Ear. Nelson.

Ingals, E. F.: Diseases of the Chest, Throat and Nasal Cavities. 4th Edition. William Wood and Co., 1900.

Jackson, C.: Foreign Bodies in the Trachea, Bronchi and Esophagus: The Aid of Esophagoscopy, Bronchoscopy, and Magnetism in their Extraction, Laryngoscope 15:257, 1905.

Jansen. A.: Surgical Treatment of Infective Labyrinthitis after Fifteen Years' Experience, Tr. Am. Laryngol., Rhinol. & Otol. Soc., 1908.

Kassel, K.: Geshichte der Nasenheilkunde. (Written in 1914; only the first volume appeared, although a comprehensive treatise was contemplated.)

Kerrison: Textbook of Ear, Nose and Throat, 1921.

Killian, G.: Tracheo-Bronchoscopy in its Diagnostic and Therapeutic Aspects, Laryngoscope **16**:921, 1906. The History of Bronchoscopy and Esophagoscopy, ibid. **21**:891, 1911.

Leonardo, R. A.: History of Surgery. New York: The Froben Press, 1943.

Liston, R.: Elements of Surgery. London: Longman, 1840. 2d ed.

Mayer, O., and Beyer, H.: Forty Years of Radical Operations; The Story of the Development of the Radical Operation, Ztschr. f. Hals, Nasen, & Ohrenheilk. Berlin, 1929.

Meyers, J. A., and Dustin, V. L.: Chevalier Jackson and the Bronchoscope, Hygeia. **22**:576, 1944.

Mettler, C. C., and Mettler, F. A.: History of Medicine. Philadelphia: The Blakiston Company, 1947, pp. 1057-1102.

Moore, I.: Peroral Endoscopy; An Historical Survey, J. Laryngol. & Otol. **41**:277, 1926.

Neumann, H.: A Clinical Study of Infectious Diseases of the Labyrinth, Laryngoscope **20**:1027, 1910.

Otosclerosis—A Resume of the Literature to July 1928, Tr. Am. Otological Society. New York: Paul B. Hoeber, Inc., 1929.

Patterson, E. J.: Twenty-Five Years in Retrospect, Tr. Am. Broncho-Esophagol. A., 1942.

Politzer, A. (1835-1920): Geschichte der Ohrenheilkunde. (This was a monumental two-volume work on the history of otology, written in 1907 and 1913 by the founder of the great Viennese School of Otology.)

Reik, H. O.: The Symptomatology and Diagnosis of Labyrinthitis, Consecutive to Purulent Otitis Media, Tr. Am. Laryngol., Rhinol., & Otol. Soc., 1907, p. 152.

Richards, J. D.: Surgery of the Labyrinth, Tr. Am. Laryngol., Rhinol., & Otol. Soc., 1907, p. 161.

Roosa, D. B. St. J.: Treatise on Diseases of the Ear, 1880.

Ruttin, E.: The Pathology of Labyrinthitis, Ann. Otol., Rhinol. & Laryngol. **21**:714-737, 1912.

Smith, H.: Report of the Garcia Jubilee Celebration held in London, March 17, 1905, Laryngoscope **15**:729, 1905.

Stevenson, R. S., and Guthrie, D.: A History of Oto-Laryngology. Baltimore: The Williams and Wilkins Company, 1949.

Stokes, W.: Treatise on the Diagnosis and Treatment of Diseases of the Chest. (Philadelphia, 1844.)

Temkin, O.: The Study of the History of Medicine, Bull. Johns Hopkins Hosp. **104**:99-106, 1959.

Thompson, St. C.: History of the Laryngoscope, Laryngoscope **15**:181, 1905.

Trousseau, A., and Belloc, H.: A Practical Treatise on Laryngeal Phthisis, Chronic Laryngitis and Diseases of the Voice. Philadelphia: Carey and Hart, 1841.

Wells, W. A.: Benjamin Guy Babington—Inventor of the Laryngoscope, Laryngoscope **56**:443, 1946.

Whiting, F.: The Modern Mastoid Operation. Philadelphia: P. Blakiston's Son and Company, 1905.

Wright, J. (1860-1928): The Nose and Throat in Medical History. (The author was a New York laryngologist and pathologist. This was published in 1902 [as reprinted from the Laryngoscope]. A second revised edition "A History of Laryngology and Rhinology" was publshed in 1914.)

Laënnec had little of that air of infallibility, that charm of a magnetic personality, that pervasive atmosphere of prosperity, or those Apollo-like physical characteristics that often go so far in the making of a successful and sought-after consultant. He was sallow, with sunken eyes, small in figure, and excessively thin. In manner he was rather cold and distant. Still, the patients appreciated his ability more and more, and in 1812 he found that his income from his practice amounted to 10,000 francs, a substantial increase from the 400 francs of seven years before.

—*Major*

New Books

BOOKS RECEIVED

The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however is not to be taken as criticism of the merit of the book.

Clinical Neurosurgery: Proceedings of the Congress of Neurological Surgeons. Edited by Robert G. Fisher, Lee Christopherson, Robert Green and William Mosberg. Baltimore: The Williams and Wilkins Company, 1959. Pp. 269, with 125 illustrations and 22 tables. *Reviewed in this issue.*

Textbook of Surgery. Edited by Guy Blackburn and Rex Lawrie, with a foreword by Sir Russell Brock. Springfield, Illinois: Charles C Thomas, Publisher, 1958. Pp. 1122. Illustrated.

Spinal Cord Compression. By I. M. Tarlov. Springfield, Ill.: Charles C Thomas, Publisher, 1957. Pp. 147, with 41 illustrations.

Le Diagnostic du Cancer d'Estomac a la Periode Utile (Diagnosis of Carcinoma of the Stomach at the Time Most Favorable for Treatment). By Rene A. Gutmann. Paris: G. Doin et Cie, 1956. Pp. 257.

Operative Surgery. Edited by Charles Rob and Rodney Smith. London: Butterworth & Co., Ltd.; Philadelphia, F. A. Davis Co., 1956. Vols. 1 and 2 of 8 (plus index). Profusely illustrated.

Functional Bracing of the Upper Extremities. By Miles H. Anderson. Springfield, Ill.: Charles C Thomas, Publisher, 1958. Pp. 463. Illustrated.

The Clinical Management of Varicose Veins. By David Woolfolk Barrow. New York: Paul B. Hoeber, 1957. Pp. 167, with 70 illustrations.

Pathology and Surgery of the Veins of the Lower Limbs. By Harold Dodd and Frank Cockett. Baltimore: The Williams & Wilkins Company, 1957. Pp. 462, illustrated.

The Surgeon and the Child. By Willis J. Potts. Philadelphia: The W. B. Saunders Company, 1959. Pp. 225. *Reviewed in this issue.*

Symposium on Glaucoma. Edited by William B. Clark. St. Louis: The C. V. Mosby Company, 1959. Pp. 314, with 99 illustrations. *Reviewed in this issue.*

Tumors and Tumorous Conditions of the Bones and Joints. By Henry L. Jaffe. Philadelphia: Lea & Febiger, 1958. Pp. 629, with 701 illustrations.

Pain: The Destroyer and the Sympathetic Origin of Dystrophy. By Miguel Lopez Esnaurrizar. Paris: Editions Lamarie, 1959. Pp. 210, with 18 illustrations.

The Triumph of Surgery. By Jürgen Thorwald. Translated from the German by Richard and Clara Winston. New York: Pantheon Books, Inc., 1959. Pp. 454, with 13 illustrations.

The Surgeon and the Child. By Willis J. Potts, Philadelphia: The W. B. Saunders Company, 1959. Pp. 255.

In his own inimitable style Dr. Potts has written an interesting and informative book. He may and does speak authoritatively concerning pediatric surgery, for he has had a tremendous amount of experience as surgeon-in-chief of the Children's Memorial Hospital of Chicago. The humanitarianism of the author shines forth from each chapter, whether he is discussing a surgical technic devised by himself or expounding the importance of diagnosis. The field of pediatric surgery has grown rapidly in the past two decades and is demanding especially trained personnel and special facilities. There is no branch of the profession that is as spiritually rewarding as is pediatrics, and in no branch is the impact of the surgeon as great as it is on these tiny patients. It is a "rapidly changing specialty. Better methods of diagnosis and improved technics of surgery will soon make obsolete much that has been . . . written" in this book. The ultimate objective of pediatric surgery will remain the same: "to give the deformed or surgically ill infant and child the best care available." The book can be recommended enthusiastically to anyone interested in pediatric surgery.

—PHILIP THOREK, M.D.

Clinical Neurosurgery: Proceedings of the Congress of Neurological Surgeons, San Francisco, 1958. Edited by Robert G. Fisher, with the collaboration of Lee Christoferson, Robert Green and William Mosberg, Associate Editors. Baltimore: The Williams and Wilkins Company, 1959. Pp. 269, with 125 illustrations and 22 tables.

The sixth volume of *Clinical Neurosurgery* contains the edited proceedings of the Eighth Annual Meeting of the Congress of Neurological Surgeons, held in San Francisco on October 30 and 31 and November 1, 1958. The volume is principally devoted to surgical procedures involving the brain stem, but there are chapters entitled "The Dawn of Neurosurgery" and "Post-Traumatic Epilepsy" (A. Earl Walker) and "The Biomedical Medical Aspects of Space Flight" (A. W. Hetherington). A total of fifteen authors contributed the fifteen chapters, but the guest of honor at the meeting, Dr. A. Earl Walker, is the author of the first three chapters, which include the two aforementioned and another on surgical treatment of the mesencephalic brain stem.

As is inevitable in a book of this type, the subjects covered are somewhat heterogeneous, but all represent worth-while contributions to the neurosurgical literature. Especially noteworthy are the chapters by Walker already mentioned and those by Ward and Wycis and Spiegel on stereotaxic procedures on the brain stem. Hamby has contributed an excellent discussion of the practical technical aspects of operation on the posterior fossal. The final chapter by Hetherington on the biomedical aspects of space flight will be of great interest to all those concerned with that subject.

The editors have again prepared a book that is important to the neurosurgeon, the clinical neurologist and the neurophysiologist.

HAROLD C. VORIS, M.D.

Symposium on Glaucoma: Edited by William B. Clark. St. Louis: The C. V. Mosby Company, 1959. Pp. 314, with 99 illustrations.

This symposium on glaucoma is written by outstanding teaching and practicing ophthalmologists. The histologic, pathologic, surgical-anatomic, biochemical, diagnostic and therapeutic aspects are presented clearly. Recent advances in the medical and surgical management of glaucoma are described. The round table discussion that concludes the volume permits the participants to express their views and theories on the important problems of glaucoma.

This book should be in the library of every ophthalmologist.

—JOHN BELLOWS, M.D.

IMPORTANT ANNOUNCEMENT

Contributors of scientific articles for publication in The Journal of the International College of Surgeons from Europe, the Near East and the Middle East should send their articles to:

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Les auteurs d'articles scientifiques destinés à être publiés dans le Journal du Collège international de chirurgiens sont priés d'adresser leurs articles à l'adresse suivante pour l'Europe, le Proche et le Moyen Orient.

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Un comité a été nommé pour l'examen des articles à paraître. Les auteurs sont priés de joindre à leur travail de brefs résumés en français, anglais, allemand, espagnol, italien et portugais si possible.

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